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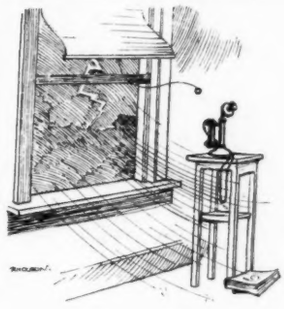

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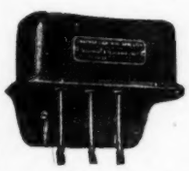

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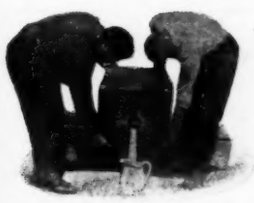

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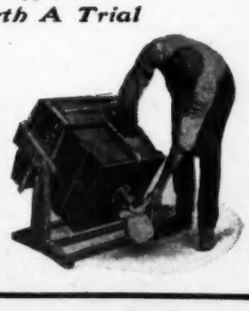

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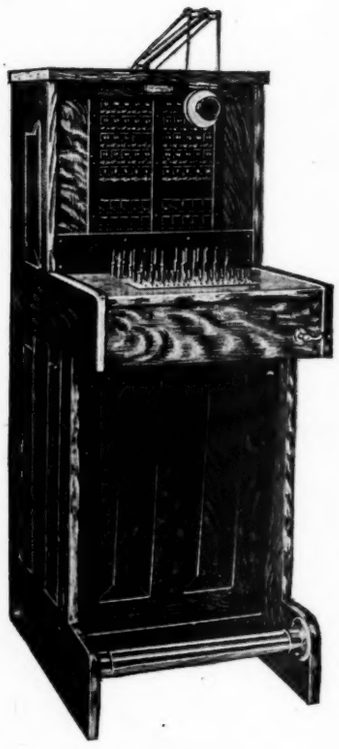

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THE AMERICAN TELEPHONE JOURNAL

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THE POWER OF A MAN.

There is a time in every man's education when he arrives at the conviction that envy is ignorance; that imitation is suicide; that he must take himself for better or for worse as his portion; that though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given to him to till. The power which resides in him is new in nature, and none but he knows what that is which he can do, nor does he know until he has tried.—Emerson.

Get Your Orders in Early.

Telephone operating companies which are contemplating the purchase of equipment and supplies should plan to get their orders to the manufacturer early and give him three or four months leeway in filling the demands. From every factory comes the same story of the difficulty and delay in getting raw materials. The amazing increased demand for nearly all metals, caused by the European war and the rising tide of industrial activity in the United States, is hampering every manufacturer in obtaining raw material, and, therefore, naturally compels him to delay shipments to his customers several months.

One of the prominent telephone manufacturers said the other day: "I do not believe that one operating man in fifty realizes that we are not able to get deliveries of brass, brass products, German silver, aluminum, steel and, in fact, practically any of the base materials used in the manufacture of switchboard and telephone apparatus, in less than four months from date of receipt of order by the raw material producers. Although they make promises now of deliveries within four months, in most cases they take from two to three months longer. It is the most unusual condition that has ever confronted the manufacturer."

In view of these facts, it is plain that operating companies should anticipate their wants as long a time in the future as possible, which is what the manufacturer is compelled to do with regard to the raw materials he requires in his factory. The telephone exchange manager knows how he appreciates a little co-operation from his subscribers, and how valuable it is in helping to improve the service. The manufacturer sells service as well as apparatus, and would appreciate co-operation from the operating companies in the matter of ordering ahead of time. Both buyer and dealer would profit by a little forethought in this direction.

How Young We Are!

After all, when you stop to think of it, the telephone is comparatively a very recent arrival in the family of inventions. This thought is suggested by the belated news that in December, Tokyo, Japan, celebrated the twenty-fifth anniversary of the opening of telephone service in that Oriental city. The latest statistics show there are 1,100 exchanges serving 200,000 subscribers in Tokyo. The annual profits of the company are estimated at $500,000.

The Japanese, known as the Yankees of the East because of their progressiveness, have always been keen to seize promptly upon all modern means of making life easier and more efficient, and still they have been using the telephone but twenty-five years.

Even in America, the birthplace of the telephone, this invention is less than forty years old—and forty years is a mere span in the growth of most of the great industries which have required many years to grow into the popular favor universally accorded the telephone. It is hard to realize this. So much has the civilized part of the world come to depend upon the "talking wire" that one is inclined to grow into the notion that it was always with us, like the railroads. The Japan celebration, however, reminds us that the telephone is a mere infant in point of years, but it is a pretty husky baby at that.

Try Another Key

By HERBERT KAUFMAN

Mountains aren't as big as men. Human will overtowers and overpowers everything on earth. Nature hasn't yet stacked anything too high for ingenuity to knock down.

The hardest thing we know is a man's head—he can cut diamonds and ram tunnels with it.

In that inexhaustible warehouse, your brain, there's a rule, an implement, a philosophy or a batch of explosives, somewhere among its millions of cells, to deal efficiently with any emergency. History has compiled a partial inventory of its resources. All past talent and genius is a catalogue of your potential abilities.

Everybody may do what anybody has done, but the experience and experiments of others, did not locate the tools you require to handle problems they didn't meet. Research tells how previous undertakings were tackled, but you must search yourself to learn new ways.

There are more undisclosed stunts in your mind than of record. Progress can't dig them out of hiding fast enough to exhaust the reserve stock. School boys answer riddles that the Sphinx couldn't invent, but their grandchildren will, in turn, rattle off facts that now elude Edisons and Remsens.

Granted that our voices outreach thunder and that we toast muffins with educated lightning bolts, we are still reading the first few phrases of knowledge. But, at least, we have the formula that solves every secret: Thought + work — doubt.

With the Simplon, the wireless telephone, Holland's synthetic shark, radium and aviation, already to our credit, we surely can't be expected to waste patience on people who bungle ordinary chores.

If you aren't making a decent living in these flying times, you haven't made a decent effort. What's possible, is half-done—it's just the half-done things that are impossible.

Wits sharpen upon disappointment. If you haven't a few bruises, you haven't been fighting.

Temporary failure is a phase of experiment. The incandescent lamp didn't glow at the first trial, nor go at the thousandth. Even a desert will yield to a fertilizer of persistence and intelligence.

All fixed obstacles must eventually succumb to thought. The obstacle remains the same and in the same place, but man and his mind are mobile—he can keep altering and improving his tactics and mount steadily upon the shoulders of previous effort, until he stands where he can strike to win.

There's more than enough opportunity. But most folks expect an open door—or they turn the knob and turn away, because the first notion they have at hand won't turn the latch.

A "yale" mind can't overcome difficulties; it only accommodates one key.

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The Pure Electron Discharge and Its Radio Applications

Thermionic Current in Radio Telegraphy and Telephony—Theory, Construction, Characteristics and Use of the Pliotron—Paper Presented Before Institute of Radio Engineers, April 7, 1915—Reprinted by Permission from September "Proceeding of the Institute of Radio Engineers"

By Irving Langmuir

It has been known for nearly 200 years that air in the neighborhood of incandescent metals is a conductor of electricity. Elster and Geitel studied this phenomenon in great detail, and published the results of their investigations in a series of papers in "Wiedemann's Annalen" during the years 1882-1889.

Historical.

In most of their experiments, they placed a metal plate close to a metallic filament within a glass bulb, and studied the charge acquired by the plate under various conditions of filament temperature and gas pressure. They found in most gases that the filament tended to give off positive electricity when it was at a red heat, but at very high temperatures it gave off negative electricity more easily than positive. When the vessel was exhausted as completely as was possible in those days, the tendency to give off positive electricity was much decreased and did not persist, whereas the tendency to emit negative electricity was apparently stronger than ever.

A similar discharge of negative electricity from the carbon filament of an incandescent lamp to an auxiliary electrode placed within the bulb was observed and studied by Edison and has since been known as the Edison effect. Fleming, in 1896 [Proc. Roy. Soc. 47, 118 (1896) and Phil. Mag. 42, 52 (1896)] investigated and described this effect in detail.

J. J. Thomson [Phil. Mag. 48, 547 (1899)] showed that in the case of a carbon filament in hydrogen at very low pressures, the negative electricity is given off by the filament in the form of free electrons having a mass about 1/1800th of the mass of a hydrogen atom, and constituting in reality atoms of electricity. Owen [Phil. Mag. 8, 230 (1904)] showed that a heated Nernst filament also gives off electrons, and Wehnelt [Ann. Phys. 14, 425 (1904)] proved that the electric current from a lime-covered, platinum cathode (Wehnelt cathode) is carried in the same manner.

Richardson [Phil. Trans. 201, 516 (1903)] applied the electron theory of metallic conduction to the electron emission from heated metals, and was thus able to develop a theory of this effect. In order to account for the conduction of heat and electricity by metals, Riecke and Drude had assumed that metals contain electrons which are free to move under the influence of an electric force and which are in constant vibratory motion similar to that of the molecules of a gas.

Richardson assumed that these free electrons are ordinarily held within the metal by an electric force at the surface, just as the molecules of a liquid are prevented from escaping by a surface force related to the surface tension. If the velocity of an electron is sufficiently high, it may be able to overcome the surface force and escape. Since the average velocity of the vibratory motion increases with the temperature, the number of electrons which reach the necessary critical velocity to escape, will increase very rapidly with the temperature. These considerations are strictly analogous to those of the evaporation of a liquid, so that the number of electrons escaping should increase with the temperature according to the same laws as those governing the increase of the vapor pressure of a liquid as the temperature is raised.

It had already been shown that the vapor pressure, p, of a substance varies with the temperature, T, according to a relation of the form, $p = A\sqrt{T}\xi^{-\frac{\lambda}{2T}}$ where A is a constant, λ is the latent heat of evaporation of the liquid (or solid), and ξ is the base of the natural system of logarithms. Richardson was thus led to conclude that the current from an incandescent metal should increase according to an equation of a similar form, namely, $i = a\sqrt{T}\xi^{-\frac{b}{T}}$ Here i is the current per square centimeter at the temperature T, and b is a constant which should be half the latent heat of evaporation of the electrons.

A curve showing the electron emission from heated tungsten, calculated with the use of appropriate constants from the above equation, is given in Fig. 1.

Richardson suggested that the currents obtained by the emission of electrons or ions from incandescent bodies should be called *thermionic* currents, a term which has since come into very general use.

According to Richardson's theory, an incandescent metal at a given temperature emits a certain number of electrons which is independent of the electric field around the heated body.

If a positively charged body is placed near the heated filament, the electrons will all be drawn away from the filament and will strike and be absorbed by the positively charged body. The motion of these electrons constitutes an electric current, the hot filament being the cathode and the positively charged body the anode of the discharge.

If, however, there is no electric field around the heated filament, or if a negatively charged body be placed near it, the electrons, which are emitted from the filament, return to it again and are re-absorbed, and therefore no current flows between the two electrodes.

According to this viewpoint, the electron emission is the same whether a thermionic current flows or not. As the potential of the cold electrode or anode is increased, a larger and larger proportion of the electrons emitted are drawn to the anode, so that the thermionic current increases. As the potential is further raised, a point is finally reached at which all the electrons emitted pass to the anode, so that a further increase in voltage causes no increase in current. The current is then said to be "saturated."

Richardson, in 1902, determined the relation between the saturation current from a heated platinum wire and a cylinder around it, and found that i varied with the temperature in accordance with the equation previously given. For other substances, also, he found the relation to hold.

Since 1903, Richardson's theory of thermionic currents has been the subject of much investigation and discussion. H. A. Wilson [Phil. Trans. 202, 243 (1903)] found that the electron emission from platinum at high temperature was decreased to 1/250,000th of its former value by a preliminary heating of the platinum in oxygen, or by boiling in nitric acid. The admission of a little hydrogen brought the current back to its former value.

Wehnelt [Ann. Phys. 14, 425 (1904) and Phil. Mag. 10, 80 (1905)] discovered that platinum cathodes covered with lime emit vastly more electrons than platinum alone. He proposed using tubes containing such cathodes as rectifiers for alternating current of 100 or 200 volts, and described a Braun tube in which very soft cathode rays (100 to 1,000 volts) could be produced. Wehnelt worked usually with gas pressures ranging from 0.01 to 0.1 millimeter of mercury, the lowest pressure

recorded being 0.005 millimeter. Under these conditions the paths of the cathode rays were visible, showing that there was strong ionization of the gas.

Soddy [Phys. Zeit. 9, 8 (1908)] found that the large currents obtainable from a Wehnelt cathode stopped suddenly if the residual gases in the vacuum tube were absorbed by vaporizing some metallic calcium. This work of Soddy attracted considerable attention and made many investigators feel that the thermionic currents in general were dependent on the presence of gas.

Lilienfeld [Physik. Zeitschr. 9, 193 (1908)], however, considered that Soddy's experiments did not show that the electron emission from the Wehnelt cathode had decreased, but suggested that the decrease in current might be caused by the building up of a negative charge in the vacuum because of the large number of electrons needed to carry the current.

Fredenhagen [Verh. deut. phys. Ges. 14, 384 (1912)] in 1912 studied the electron emission from sodium and potassium, two metals that Richardson had found particularly good sources of electrons, and concluded that the electrons are only emitted as a result of the presence of gas. He suggested that if a perfectly clean metallic surface could be obtained in a perfect vacuum, the electron emission would cease entirely.

Pring and Parker [Phil. Mag. 23, 192 (1912)] in the same year measured the currents from incandescent carbon rods in a vacuum. They found that with progressive purification of the carbon and improvement in the vacuum, the currents decreased to extremely small values. They conclude that "the large currents hitherto obtained with heated carbon cannot be ascribed to the emission of electrons from carbon itself, but that they are probably due to some reaction at high temperatures between the carbon, or contained impurities, and

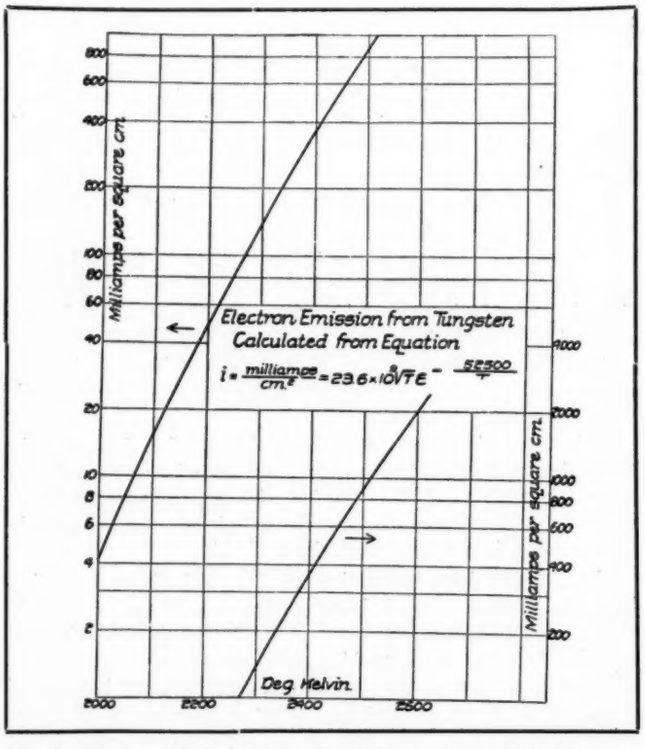


Fig. 1. Electron Emission from Tungsten in a "Perfect" Vacuum.

the surrounding gases, which involves the emission of electrons."

More recently Pring [Proc. Roy. Soc. A 89, 344 (1913)] repeated these experiments under still better vacuum conditions and finds the former results confirmed. He concludes that "the thermal ionization ordinarily observed with carbon is to be attributed to chemical reaction between the carbon and the surrounding gas. . . . The small residual currents which are observed in high vacua after prolonged heating are not greater than would be anticipated when taking into account the great difficulty of removing the last traces of gas."

A similar feeling gradually arose in regard to the photo-electric effect, a phenomenon resembling the electron emission from incandescent metals, except that the electrons are emitted by the action of light—usually ultra-violet light, instead of heat.

Pohl and Pringsheim [Phys. Zeit. 14, 1112 (1913)] find that the photo-electric effect is very much decreased by improving the vacuum, and suggest that perhaps the whole effect is due to interaction between the gas and the metal. Wiedmann and Hallwachs (the latter the discoverer of the photo-electric effect) [Ber. d. Deut. Phys. Ges. 16, 107 (1914)] go further and state emphatically, as a conclusion from experiments with potassium, that "the presence of gas is a necessary condition for appreciable photo-electric electron emission."

Fredenhagen and Kuster [Phys. Zeit. 15, 65 and 68 (1914)] conclude that the same is true for the photo-electric effect from zinc, and in a still later publication Fredenhagen [Verh. d. Deut. Phys. Ges. 16, 201 (1914)] find that both the photo-electric and thermionic electron emission from potassium are entirely dependent on the presence of gas.

We see, then, that there were the best of reasons for believing that it would be impossible to get any electric discharge through a perfect vacuum, because one could not expect to get any electrons from the electrodes. In the operation of ordinary X-ray tubes it was well known that a certain amount of gas was necessary. Porter [Ann. Phys. 40, 561 (1913)] studied the dynamic characteristics of the Wehnelt rectifier and found that with pressures as low as 0.001 millimeter, there was a tendency for the current to become unstable, fluctuating periodically between zero and a higher value.

With higher pressures, this difficulty was avoided, but the characteristics clearly showed a sort of hysteresis loop, the current with ascending voltage being different from that obtained with descending voltage.

My active interest in thermionic currents began in connection with some experiments on electrical discharges occurring within tungsten lamps. According to Richardson's data on the electron emission from such metals as platinum and osmium, the currents that might exist across the evacuated space in a tungsten lamp would be very large; in fact, the current density, at temperatures close to the melting point of tungsten, might be expected to be several hundred amperes per square centimeter. Of course it is evident at the outset, that the current flowing from one part of a filament to the other through the vacuum must actually be very small in any ordinary lamp.

It was known that the vacuum in a tungsten lamp is extremely high, and measurements indicated that in well exhausted lamps after 100 hours' life, the pressure was probably less than one millionth of a millimeter of mercury. Taking these two facts into account, the very existence of a tungsten lamp seems strong evidence that thermionic currents in high vacuum must be very small, if not entirely absent.

When this effect was studied in more detail, it was found that the smallness of the currents in a lamp was not due to any failure of the filament to emit electrons, but was due entirely to an inability of the space around the filaments to carry the currents with the potential available in the lamp.

In one case, two single loop tungsten filaments were mounted side by side in the bulb. After the bulb was exhausted in the best possible way and the filaments were thoroughly aged and freed from gas, one of the filaments was heated while a positive potential was applied to the other through a galvanometer. The hot filament thus served as cathode in the discharge occurring in the lamp. As the current through the cathode was increased, the thermionic current, as measured

by the galvanometer, increased at first, according to Richardson's equation as shown in Fig. 1; but beyond a certain point, as indicated in Fig. 2, the further increase in the temperature of the cathode produced no further increase in thermionic current.

The curve representing thermionic current as a function of temperature therefore consists essentially of two parts: First, a part in which Richardson's equation applies; second, a part in which the current is independent of the temperature.

In the first part of the curve, it is found that the current is independent of the voltage, or shape and size of the anode, but in the second part of the curve the current is affected by both of these factors and may also be either increased or decreased by placing the lamp in a magnetic field. It is thus evident that the only reason that the current does not continue to increase, according to Richardson's equation, is that the space between the electrodes is capable of carrying only a certain current with a given temperature difference.

The explanation of this phenomena was found to be that the electrons carrying the current between the two electrodes, constituted an electric charge in the space which repelled electrons escaping from the filament and caused some of them to return to the filament.

A further theoretical investigation on the effect of this space charge led to the following formulas by which the maximum current that can be carried through a space (of certain symmetrical geometrical shapes) may be calculated.

In the case of parallel plates of large size, separated by the distance x, the maximum current per square centimeter, i, is

$$i = \frac{\sqrt{2}}{9\pi}\sqrt{\frac{e}{m}}\,\frac{V^{\frac{3}{2}}}{x^2} \qquad (1)$$

Here, e is the charge on an electron, m the mass of an electron, and V the potential difference between the plates. If we substitute the numerical value of e/m and express i in amperes per square centimeter and V in volts, then this equation becomes

$$i = 2.33 \times 10^{-6}\,\frac{V^{\frac{3}{2}}}{x^2} \qquad (2)$$

In the case of a wire in the axis of a cylinder, the maximum current per centimeter of length from the wire is given by the equation

$$i = \frac{2\sqrt{2}}{9}\sqrt{\frac{e}{m}}\,\frac{V^{\frac{3}{2}}}{r} \qquad (3)$$

If we substitute numerical values as before, we find

$$i = 14.65 \times 10^{-6}\,\frac{V^{\frac{3}{2}}}{r} \qquad (4)$$

where i is the current in amperes per centimeter of length, and r is the radius of the cylinder in centimeters.

These equations have been found to agree accurately with experiments when the vacuum is so high that there is no appreciable positive ionization.

Extremely minute traces of gas, however, may lead to the formation of a sufficient number of positive ions to neutralize, to a large extent, the space charge of electrons and thus very greatly increase the current carrying capacity of the space. For example, a pressure of mercury vapor of about 1/100,000th millimeter has, under certain conditions, been found to eliminate completely the effect of space charge, so that a current of 0.1 ampere was obtained with only 25 volts on the anode, whereas, without this mercury vapor, over 200 volts were necessary to draw this current through the space.

Besides this enormous effect on the current carrying capacity of the space, many gases have a great influence on the electron omission from the cathode. But in every case where the cathode is of pure tungsten, the effect of gas is to decrease, rather than increase, the electron emission. For example, it is found that a millionth of a millimeter of oxygen, or of a gas containing oxygen, such as water vapor, will cut the electron emission down to a small fraction of that in high vacuum.

As a result of this work, we became firmly convinced that the electron emission from heated metals was a true property

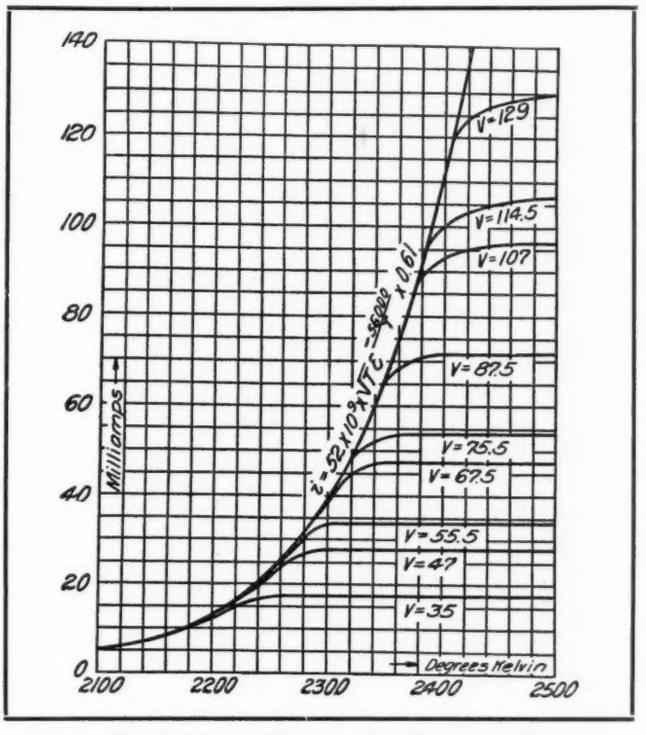


Fig. 2. Effect of Space Charge on the Thermionic Currents.

of the metals themselves and was not, as has so often been thought, a secondary effect, due to the presence of gas.

Further investigation showed that with the elimination of the gas effects, all of the irregularities which had previously been thought inherent in vacuum discharges from hot cathodes, were found to disappear. In order to reach this condition, however, it was not sufficient to evacuate the vessel containing the electrodes to a high degree, but it was essential to free the electrodes so thoroughly from gas that gas was not liberated from them during the operation of the device. It was also necessary to free the glass surfaces very much more thoroughly from gas than had been thought necessary previously.

The difficulty thus consists, not in the production of the high vacuum, but in the maintenance of this vacuum during the use of the apparatus. As the voltage applied to the terminals was increased and as the current density in the discharge increased, the tendency for the gas residue to become ionized became very much more marked and the difficulties in maintaining a sufficiently high vacuum increased still further. However, by special methods of exhaustion and by special methods of treating the electrodes, these difficulties have been overcome. It has thus been possible to construct apparatus in which a large current density can be obtained and potential differences of much more than 100,000 volts may be applied without obtaining effects attributable to positive ionization.

In previous devices which employed discharges through vacuum, either with or without a hot cathode, there was always evidence of positive ionization if the current density was increased above an extremely low value, or if potentials over 50 or 100 volts were applied while a current of as much as a few milliamperes was flowing. The effects of this positive ionization manifested themselves in many ways. If the ioniza-

tion was sufficiently intense, a glow throughout the tube was visible. For example, in the Braun tube, with a lime-covered cathode, Wehnelt states that as high a vacuum as possible should be obtained, but he speaks of being able to see the path of the cathode rays. It has apparently always been assumed that cathode rays of sufficiently high intensity can always be seen, but of course such a luminosity is direct evidence of ionization of the gas.

One of the most sensitive indications of the presence of positive ionization is the failure of the current to increase with the voltage in a regular manner, as shown in equations (2) and (4). If much gas is present, and by this I mean a pressure in the order of 1/10,000th millimeter, the current-voltage curve often shows decided kinks when the voltage is raised above 50 or 100 volts. In many cases the discharge is unstable and fluctuates periodically between two values. All these effects tend to be extremely erratic, since they vary with the composition and the pressure of the residual gases, and these, in turn, are altered by the discharge taking place through them. For example, in the ordinary X-ray tube, the vacuum continually improves and it is necessary, from time to time, to admit fresh portions of gas.

With higher voltages, perhaps the most troublesome feature of positive ionization is its tendency to disintegrate the cathode. The positive ions, moving under the influence of the electric field, acquire high velocity and, when they strike the cathode, cause rapid disintegration and ultimate destruction of the electrode. With a pure electron discharge, however, there is no disintegration of the electrode caused by the discharge and the filament lasts the same length of time as if no current passed through the vacuum.

Another effect, produced by positive ionization, is the emission of electrons from the cathode under the influence of the positive ion bombardment. These electrons, which constitute the so-called delta rays, escape from the cathode with considerable initial velocity, and are therefore capable of charging up a third electrode in this space to a potential of ten or fifteen volts negative with respect to the cathode.

With the pure electron discharge, none of these effects are present. The cathode rays are entirely invisible, the current voltage curve is a smooth curve and follows the 3/2 power law, in case the filament temperature is sufficiently high and the shape of the electrodes is such that the small initial velocities of the electrons from the cathode do not play too large a role. It is possible to obtain a very high current density in this type of discharge, but in order to overcome the space charge effects, it is then necessary to use a very strong electric field close to the cathode.

Devices Employing a Pure Electron Discharge.

Dr. Coolidge [Phys. Rev. 2, 409 (1913)] has used the pure electron discharge in the construction of a new type of X-ray tube. In this tube the cathode consists of a small, flat spiral of tungsten wire, surrounded by a small molybdenum cylinder which serves as a focusing device, while the anode, or target, consists of a massive piece of tungsten placed near the center of the tube. With this tube it has been possible to use voltages as high as 200,000 volts in the production of X-rays. The current through the tube is absolutely determined by the electron emission from the filament which, in turn, depends on the temperature, in accordance with Richardson's equation.

The advantages of this tube over the ordinary X-ray tubes previously used are many. Perhaps the most important feature is that the current and voltage are under complete control at all times, the current being fixed by the temperature of the cathode while the voltage is simply that furnished by the transformer or induction coil used. The tube seems to have an almost unlimited life, the temperature of the filament being so low that no appreciable evaporation occurs and the absence of gas eliminating the cathodic disintegration usually characteristic of high voltage discharges in vacuum. The tube is entirely constant in its action and the erratic effects usually observed in X-ray tubes are eliminated.

Several other types of apparatus have also been developed, making use of this pure electron discharge, and these devices possess the same advantages over apparatus formerly used as the Coolidge X-ray tube possesses over the ordinary X-ray tube.

In order to distinguish these devices from those containing gas and in most cases depending upon gas for their operation, the name "kenotron" has been adopted. This word is derived from the Greek *kenos*, signifying empty space (vacuum), and the ending, *tron*, used by the Greeks to denote an "instrument."

Kenotron Rectifier.

The Coolidge X-ray tube is, of course, a rectifier for high voltage alternating current, but it is not suitably designed for this purpose. In an X-ray tube, the voltage applied must be consumed in the tube itself, whereas in the rectifier the voltage in one direction should be consumed in the load in series with the rectifier, although the voltage in the opposite direction should be taken wholly by the rectifier. In the X-ray tube, because of the great distance between anode and the cathode and the presence of a focusing device around the cathode, the space charge effects are very much exaggerated, so that it is necessary to apply several thousand volts, in order to get even 10 milliamperes of current. This voltage, necessary to overcome the space charge, is completely lost when the tube is used as a rectifier.

To overcome this loss of voltage as far as possible, the anode and cathode in the kenotron are placed close together, and everything is avoided which might tend to screen the cathode from the field naturally produced by the anode. In this way it has been possible to build kenotrons which have supplied pure electron currents of over an ampere, with a voltage drop of about 200 volts. This current, however, requires large anodes and cathodes, so that it is usually more convenient to build kenotrons with a current capacity of not over 250 milliamperes, and if it is desired to rectify larger currents than this, to place several kenotrons in parallel.

There seems to be no upper limit to the voltage at which a kenotron can operate. A kenotron has been built capable of rectifying 250 milliamperes at 180,000 volts, and there seems to be every reason to think that kenotrons could be used at very much higher potentials if desired.

The design and the characteristics of kenotrons have recently been described in a paper by Dr. Dushman (General Electric Review, Vol. 18, p. 156, 1915), and I will therefore only briefly describe these devices.

Fig. 2 gives the characteristics of a typical kenotron designed for rather large currents. The curves show the current carried by the kenotron for different filament temperatures at given voltages between the electrodes. For example, if the temperature of the filament is 2,400 degrees, the maximum current that can be obtained with any voltage is about 112 milliamperes. If, however, the resistance of the load is able to hold the current down to a value of say 54 milliamperes, then we see from the curves that the voltage drop in the kenotron would be 75.5 volts. The remaining voltage, which may be many thousands of volts, is consumed in the load in series with the kenotron.

Fig. 3 illustrates two forms of kenotrons, one for voltages

up to about 10,000, and the other one suitable for use up to 50,000 volts. With voltages higher than about 12,000 to 15,000 volts, the kenotron of the first type shown is apt to fail, because the electrostatic attraction of the anode pulls out the helically-wound filament and short-circuits

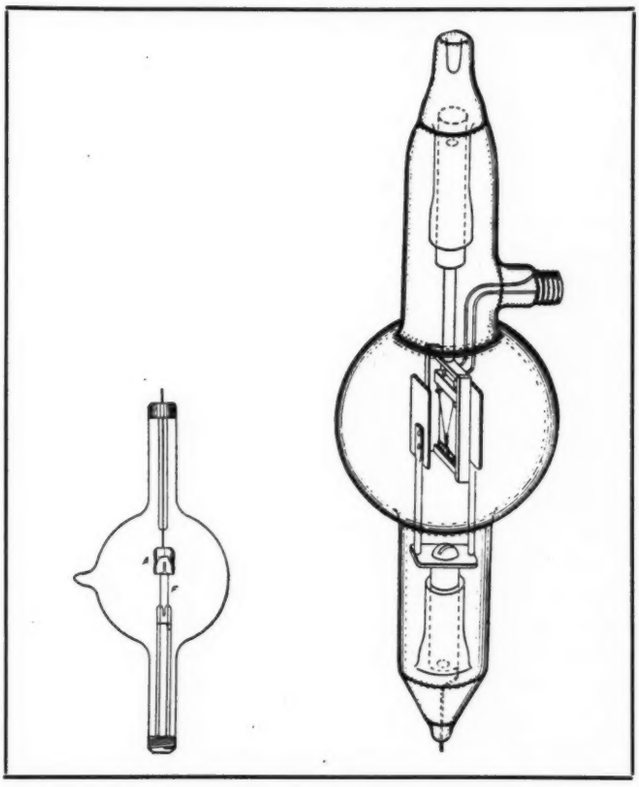


Fig. 3. Molybdenum Cap Type Kenotron and Type with Filament Between Two Parallel Plates.

the device. At the higher voltages, therefore, it is necessary to support the filament and to balance, as far as possible, the electrostatic forces acting on it.

The characteristics of the kenotron are such that the current flowing through it is always perfectly stable, so that several kenotrons can be run in parallel and each one will take its proper share of the current. This is in marked contrast with the behavior of mercury arc rectifiers, which have negative characteristics and therefore, if several are placed in parallel, one of them takes the whole of the current.

Owing to the absence of gas effects, the kenotron is a perfect rectifier, in that no measurable current flows in the reverse direction, even when voltages of 100,000 volts or more are applied. For similar reasons, it is capable of rectifying radio frequency currents, as well as audio frequency, there being no sign whatever of any lag effects.

Fort Worth Telephone Exchange Closed.

J. B. Earle, of Waco, Texas, and Ben C. Hyde, of Kansas City, Mo., have foreclosed their deed of trust lien on the property of the Fort Worth Telephone Co. and that company has closed its local exchange preparatory to abandoning the local field entirely. Messrs. Earle and Hyde were owners of the first mortgage bonds of the company and were given judgment against it for $650,000.

The bonds were held originally by a syndicate of mining men living in and around Wilkesbarre, Pa., but were acquired in 1913 by Mr. Earle and his associates. While Independent companies have been successful in most of the larger Texas towns, the Fort Worth company never has been able to make any progress. That condition is attributed to the handicap imposed by the terms of its franchise, which require it to pay a gross earnings tax of 3 per cent. and fix the maximum rate for business telephones at $3.25.

The company has opened an office for toll business at 280 West Eleventh street, where connection has been made with the Fort Worth exchange of the Southwestern Telegraph & Telephone Co., the Independent toll lines formerly connected with the local exchange of the Fort Worth company now being handled through the new office.

Plans of the Big Indiana Independent Company.

Hearing of the petition of the New Long Distance Telephone Co., the New Telephone Co., and the Indianapolis Telephone Co. to be allowed to merge, has been set for March 8 by the Indiana Public Service Commission. The plan of the merger is for the Indianapolis Telephone Co. to become the owner of the other two companies, a merger which is preliminary to the purchase by the Ohio and other interests which are to take over the property.

The company urges that the merger will provide $400,000 new money to be used for additions and improvements. The present stocks and bonds outstanding aggregate, in face value, $4,320,100. On the consummation of the merger, the aggregate face value of the stocks and bonds outstanding, less the $400,000 to be furnished as part of the merger plan, will be $4,206,500, thereby reducing the capital stock $113,600. It is apparent from this statement of the financing plan, that no effort to "kite" the capitalization is being attempted.

The petition filed with the Indiana commission shows that the total bonded indebtedness of the companies amounts to $2,050,000. On consummation of the merger by surrender and cancellation of bonds, the bonded indebtedness will be reduced to $1,556,600.

The items of stocks and bonds to be cancelled include $870,000, or all the stock of the New Long Distance Telephone Co.; $299,500 first mortgage bonds of the same company; $400,000, or all the stock of the New Telephone Co.; $44,000 first and consolidated mortgage bonds of the same company; $150,000 third mortgage bonds of the same company; $600,100, or all the preferred stock of the Indianapolis Telephone Co.; $400,000, or all the common stock of the same company. The total amount is $2,763,600.

The petition represents that all but three of the 22,701 shares have consented to the merger. Provision is made for the payment of 6 per cent. interest on the new preferred stock until December 31, 1917, and of 7 per cent. after that date.

The merger contemplates an ultimate capitalization of $8,000,000 for the consolidated company, equally divided between preferred and common stock, of which $1,900,000 of preferred stock and $1,150,000 of common stock will be issued. The reserved stock issue of $4,950,000 in the new capitalization, will be put out only as need requires, and under the consent and approval of the commission.

The directors elected to serve under the consolidation are: William Fortune, Louis Hollweg, Frank D. Stalnaker, John H. Holliday, A. A. Wilkinson, John B. Elam, John N. Carey, Harry S. New, William L. Elder, L. C. Huesmann and George G. Snowden, all of Indianapolis; William L. Moellering, of Ft. Wayne, president of the Home Telephone & Telegraph Co.; Samuel G. McMeen, of Columbus, Ohio, president of the Ohio State Telephone Co.; F. R. Huntington, Columbus, Ohio, president of the Huntington National Bank, and a member of the executive committee of the Ohio State Telephone Co.; and Frederick W. Stevens, of Ann Arbor, Mich. The officers will be: William Fortune, president; Louis Hollweg and S. G. McMeen, vice-presidents; Charles S. Norton, secretary; and Frank D. Stalnaker, treasurer.

"Telephony's" Home Study Course for Telephone Men

A Complete Presentation of the Principles Underlying Modern Telephony in All Its Branches—Arranged Systematically So That Regular Reading and Faithful Study Will Qualify Ambitious Men for Higher Positions—Prepared Under Supervision of Stanley R. Edwards—This Section Written by Jay G. Mitchell

Quiz Questions on the Preceding Installment.

304. How is the resistance of a coil calculated when the winding space, size wire, the external diameter and the diameter of the core are known, assuming that the resistance per foot of the wire is also known?

305. When the resistance and number of turns for any given coil are known, how is the number of ampere turns obtained with any given voltage calculated?

306. On what basis may different coils for use with the same relay frame, core and armature, be compared?

307. Is it necessary in manufacturing relay coils, to calculate each winding according to the theoretical *principle* outlined? According to the *methods* described?

308. How is the number of turns determined for any given coil when the external diameter, diameter of core, and size of wire with the total resistance are known? Does the character of insulation affect the result?

309. Name some of the advantages and disadvantages of using enameled magnet wire.

CHAPTER XV. Coil Windings (Continued).

310. *Comparisons of relay windings.*—In making comparisons between different relay windings, the fact should be borne in mind that there are some qualities, aside from electrical efficiency, which are most important. It is possible, for instance, that the winding which will produce the maximum number of ampere turns in a given case, may be of much lower resistance than one which would produce a *sufficient magnetizing power* to answer every requirement.

In such a case a relay winding of as high resistance as it might be possible to employ and still produce the necessary ampere turns to do the required work, should be used. A lower resistance than this would cause an unnecessarily large capacity of battery to be required. Suppose, for illustration, that a given relay frame and spool should require a winding, of 300 ohms' resistance, to give the greatest possible number of lines of force. If this relay were to be used for a line relay in a common battery exchange, it might be possible that with a winding measuring 500 ohms in resistance the relay, with a battery working at 24 volts, would pull up its armature and operate its spring contacts satisfactorily over a maximum line resistance of 1,000 ohms. Under ordinary conditions such a relay would probably be considered perfectly satisfactory for use as a line relay in any common battery exchange.

311. *Winding resistance and battery current.*—In an exchange with 2,000 working lines and an average calling rate of 10 calls per day per line, the total number of calls received at the switchboard would be 20,000. On each call a line relay would be energized. Suppose that on the average call each line relay were energized seven seconds before the operator answered. This would mean that with the 20,000 calls, the line relays in the aggregate would be energized a total of 20,000 times for seven-second periods, or 140,000 seconds, equivalent to 38.88 hours per day. Now, if the average loop resistance of the lines in this exchange be 200 ohms and the line relay has the most efficient winding of 300 ohms' resistance, the condition, as far as battery capacity is concerned, would be the same as maintaining a circuit for the battery current of 200 plus 300, or 500 ohms for 38.88 hours.

With a 24-volt battery the current that would flow in such a circuit would be 0.048 ampere (24 divided by 500). Since the condition exists for a total of 38.88 hours per day —the time in the aggregate consumed by all the line relays on incoming calls—the total amount of battery capacity required to take care of this part of the call only, is 38.88 times 0.048, or 1.86 ampere hours.

If the relay with the winding of 500 ohms' resistance had been employed instead, the resistance of the battery loop would have been 500 ohms plus 200 ohms, or 700 ohms. The current flow with the same battery voltage would have been 0.0342 ampere (24 divided by 700). The ampere hours of battery capacity required to cover the demands for power to complete this part of the telephone service for the day would then be 38.88 times 0.0342, or 1.32 ampere hours.

In other words, the use of the relay with a resistance of 500 ohms would effect a saving, under the imaginary conditions outlined, of 0.54 of an ampere hour or 29 per cent. over the result obtained with the relay of the greatest electrical efficiency in executing this one part of a call.

312. *Relay windings and power economy.*—It is clear from the illustration that a considerable saving would result from a careful consideration of *all* relay windings from the standpoint of the demands made on the battery as well as from the standpoint of pure electrical efficiency. The foregoing results may be compared in tabular form as follows:

Line Relay Resistance.	Ampere Hours per Day Required for Line Relay.	Saving, Per Cent.
300 ohms	1.86 A. H.	....
500 ohms	1.32 A. H.	29

The matter of economy in battery capacity required to handle the ordinary number of telephone calls per day, is one of the most important items for the designer of telephone coil windings for common battery exchange equipment to consider. In every complete or incomplete connection there are other relays which are in service much longer

than is the line relay. Such relays should be the subject of especially careful scrutiny, as the cost of power is one of the component items in the cost of furnishing telephone service.

313. *The actual commercial design of coil windings.*—It should be clearly stated again, that the actual design of coil windings is not so simple a matter as might appear from the calculations that have been outlined. The method of procedure is along the general lines given, but it always involves trial in addition to calculation. That is to say, the coil winding is first calculated as accurately as possible, the bobbin is wound in accordance with the specifications as calculated and upon the basis of the concrete result obtained, changes may or may not be necessary in order to arrive at the result desired.

If the external diameter of the same size wire with the same kind of insulation were always the same, the matter would be simpler. But even if that were true, the skill or lack of skill in the winding room and the degree of manufacturing accuracy deemed necessary in the bobbin itself would always affect the result. Again the service for which the coil winding is intended may be either intermittent or continuous. It is necessary, therefore, to design the winding in view of the fact that the current, in different cases, may be flowing through the winding intermittently or continuously. If the current is interrupted for a part of the time, the coil will not have to be designed to withstand as great a heating effect as it would were the flow of current continuous.

It is much easier to work out winding specifications for coils using the larger sizes of wire. The reason for this is, of course, due to the comparatively small part of the total space occupied by the insulation in the larger sizes.

314. *Winding data based upon actual obtained results.*—From a great number of wound coils the results as to space utilization and relative efficiency of various kinds of insulation for

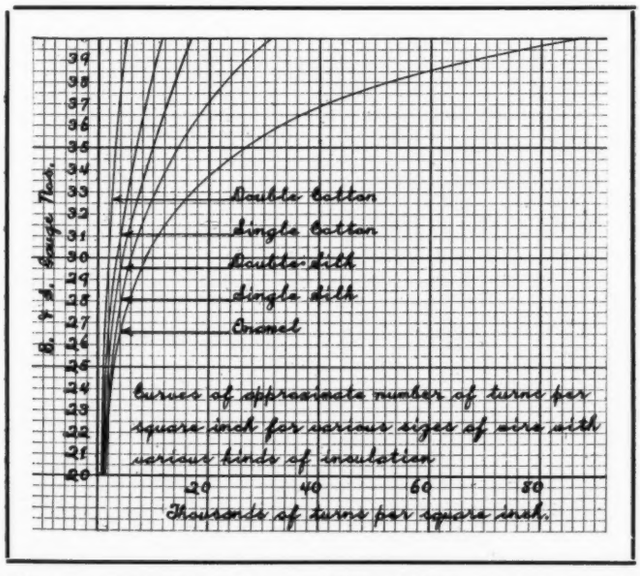


Fig. 128. Approximate Turns of Magnet Wire Per Square Inch.

wire of the sizes used in telephone coils have been tabulated. Some of the more common results, based upon the common kinds of insulation are shown in the curves, Fig. 128.

These curves may be used as a general guide in working out the preliminary winding specifications, it being understood that the results shown are not and cannot possibly be mathematically accurate for specific coils. A very short calculation will demonstrate how great a variation exists between calculated results and the actual results given by the curves.

315. *Supplementary insulation.*—It is quite often necessary to supplement the insulation of the wire itself by additional means of electrical or mechanical separation, or both. This

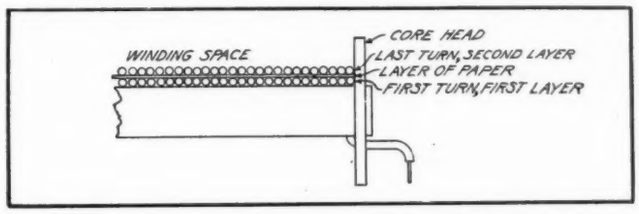


Fig. 129. Need for Insulation Between Layers in Some Windings.

is the condition in all coils whose adjacent turns are likely to be subjected to higher differences of potential than it is possible to guard against by the ordinary silk, cotton, or enamel wire coverings. In Fig. 129 are shown a few of the turns on one end of such a coil.

If it be supposed that this coil is likely to operate with a difference of potential between the terminals of 75 volts—a condition not at all unlikely in certain telephone ringer coils—and that the wire of the coil is 1,000 feet long, it should be very clear that the average difference of potential between points on the wire one foot apart would be equal to 75 divided by 1,000 or 75/1000 (0.075) volt. Should the first layer have a length of 90 feet and the second layer 110 feet, the difference of potential between the end of the second layer and the inside or starting end of the entire coil would, therefore, be 200 times 0.075 volt or 15 volts.

If the current in the coil were continuous and direct the condition would not be serious as 15 volts is extremely unlikely to break down even the lightest wire insulation. Should there be any sudden interruption of the current flowing in the circuit, if the coil in question were a relay coil, this voltage between the beginning of the winding and the wire immedately above it, might be greatly increased, owing to inductance reactance. If the current in the coil were alternating, such as ringing current, there would be times in each alternating cycle when the strain on the insulation between these two turns would be greatly increased.

In any event, it is clear that wider separation and higher insulation is required at this point, and at other similar points in the winding, than is necessary between any two other adjacent turns. In coils of this general classification, therefore, it is customary to wind a layer of oiled linen, or of paper, over each layer of wire as it is completed. This is considered standard practice in *all coils* wound with enamel wire. The total economy in space effected by the use of enamel wire is so great that it is possible to devote some winding space to this additional paper or oiled linen layer without occupying as great a percentage of winding space with insulation as would be occupied by either silk or cotton covering on the wire.

(To be Continued.)

Private Branch Exchange in San Diego, Cal., Hotel.

The Pacific Telephone & Telegraph Co. recently completed the installation of a 600-line private branch exchange in the U. S. Grant Hotel, San Diego, Cal.

Riding in a Circle

Some Competition—Subscribers' Lists—Making Prosperity Permanent

By J. C. Kelsey

As I write, I am on the New York day express. It is a fast Pennsylvania train, and with no apparent effort carries multitudinous passengers from Pittsburgh in ten hours. Strange to say, no extra fare is charged for this service. It would seem that another lost opportunity of history has been told to go around to the back door. But the cause is competition—a competition of the proper sort, something appreciated by both stockholder and patron.

You have heard of the Empire State Express—all your life you have read of this train. It is as well known to the intellectual and pious as the Columbia bicycle, the Eastman kodak, the Victrola and Lydia Pinkham. Who has not heard of famous "No. 999," that beautiful engine which came to the Chicago World's Fair too proud to haul anything but this aristocratic train over the historic rails of Vanderbilt name.

The New York Central is an aristocracy, while the Pennsylvania Railroad seems to be a democracy. The former seems to be rather careless in a way, indifferent and partially tolerant to the passenger who idolizes it. The latter is different. There seems to be a hustle and a bustle about it, iron-banded, careful, efficient, heartless, yet making the prompt transportation of passengers a proud business. There is none of the nobility-in-trade idea about this democratic yet autocratically controlled road through the heart of rich and wonderful Pennsylvania.

Since the Empire State Express gave Buffalo a ten-hour service, what was more natural than for Pittsburgh to demand the same. Competition—not the usual side by side variety either—gave the steel man of Pittsburgh everything the Buffalo man had and more.

The Pennsylvania road built a huge depot in New York. The New York Central did likewise and made a better job of it, having the advantage of an experience.

If the Pennsylvania system built a fort 83½ miles out, and armed it with six-inch guns, only a few days would elapse before the New York road would build a bigger fort 83½ miles out and put in ten-inch guns.

These two giants, with liabilities greater than our national debt, go to great limits in the practice of competition, but never to extremes.

They surely present a lesson to all thoughtful telephone men. No rates are cut, no free service is given, and every legitimate item is charged for—as much as the public will pay and yet patronize. It demonstrates that in spite of regulation and control, the proper charge for service is all that the traffic will bear.

Judge N. G. Hunter, our tall telephone "Sycamore of the Wabash," once asked if I could write a story without reference to the Johnstown Telephone Co.

I must admit that I am proud of this company as I am of LaCrosse, Ft. Wayne, Lafayette, Galesburg and so many others. So I stopped between trains to visit with Edward Schade and Dr. Griffith, the men who have stood by this successful company since its birth.

Today, this company has over 8,000 telephones. Its management with enthusiasm, faith and confidence which every man should have, can see 15,000 telephones in 1930.

It might be said that the last great telephone battle was fought here. A telephone fight usually comes to an Independent telephone company in early life, or when it is in a sort of a nebulous stage, long before stockholders have learned to mobilize for war. But the fight in Johnstown came when the Independent company had 5,000 telephones, plenty of cash resources, and fifteen years' experience.

This was no ordinary fight, and it classed with the European war in which gas bombs, liquid fire, submarines, balloons and aeroplanes have a heavy part.

The new management of the Bell interests did not look with favor upon this sturdy telephone fortress. True to human nature, the heads decided that the old management was careless, lazy or incompetent in allowing the Independents to live. So the war began.

It was not the life of the Independent telephone company which was at stake at all, for there was a more important issue—the life and safety of the telephone business.

The telephone business really has one asset. Upon this asset are based bonds, collateral trusts, debentures, preferred and common stock. Bonds and such securities are supposed to be based upon something fixed, substantial and realizable.

Bonds are not placed on buildings, switchboards and outside construction at all. They are placed on an asset which ranks far above all physical assets—that is the subscribers' list which has grown with the years. Upon this asset—the subscribers' list—depends the safety or danger of telephone securities.

Had the Bell interests won at Johnstown, it would have been a deadly and costly victory. It would have undermined the very existence of the victor as well as the vanquished.

Had the local company with powerful business men in control, after the people had grown accustomed to its service the children knowing no other name, been unable to stem the tide of invasion and disaster, then indeed might the owner of every telephone security tremble.

Had the local company lost, what stability would there be to the 616,795 subscribers of the New York Telephone Co.? What stability would the Chicago Telephone Co. have or any other company which has lived, grown and served to the best of its ability?

But it was demonstrated by the Johnstown Telephone Co., and as clearly by the Chicago Telephone Co. and numerous other companies which have been invaded the last ten years, that a subscription list of fairly treated patrons is as staple as wheat, and stable as the Rock of Ages.

I never did look upon the battle of Johnstown as a personal victory or defeat. The directors of the company were frightened as any other group might well be at the onset of a crucial battle. I always insisted that the battle would have been won if every director and official had spent the period in California.

The first company on the ground, whether Independent or Bell, with the courage of conviction, willingness to serve and confident of the future, can hold its supremacy forever, for an honestly-earned subscribers' list has the resisting power of a Gibraltar. It has been fully and conclusively demonstrated in the wonderful and historic city of Johnstown.

The Johnstown company has a qualified toll line agreement. It is still in the experimental stages and men can still disagree as to who wins or loses.

The reader needs little introduction to this agreement whereby the competing Independent can get Bell long distance serv-

ice. The charge of ten cents is a sort of indemnity to offset the possibility of confiscation.

In the Ingersoll case whereby the Canadian company sought to compel physical connection, the Bell defense was that it would work ruin to its local company if its Independent competitor were given the long distance service. Thus, the denial of commission and an additional charge of ten cents per message was ordered by the Dominion of Canada Railway Commission as a proper safeguard against confiscation of local property.

The Johnstown company had the following experience during the last quarter:

Messages to the number of 367 were sent out and 713 were received which went to distant A. T. & T. points. Originating messages numbering 311, were subject to a ten-cent charge, either paid by the company or subscriber, and 625 messages were received upon which the Bell company could collect 10 cents additional.

For the quarter, the Bell interests collected $93.60 from patrons who used their long lines in and out of Johnstown local.

It seems plain that the Johnstown connection is valuable to the Bell company as a terminating point. But the question is still unanswered as to whether the long distance business created offsets the local losses, in both prestige and advantage.

The Keystone Telephone Co., of Philadelphia, is thriving. Its bonds sell readily at 98½ and its preferred stock stands on a 132-basis.

It has been recently held that the heirs and assigns of the old Interstate Telephone Co. of New Jersey, now defunct, must carry out the contracts of the old company. This gives the Keystone company wide open toll connections with Bell points in New Jersey, with guarantees that the receipts shall never fall below the old arrangement.

New York City connection is still missing to the rank and file of Independents, who do not care to give the qualified toll agreement a trial.

The East is busy. Side tracks are full of freight cars. Homes for workmen, for years in bad repair or wholly deserted, have been repaired and new ones added. Every mill runs night and day, sparks fly and furnaces glow in every direction.

Activities are so great that men are now beginning to worry over their permanency. The human race, as do some outlaws, seems to think that the world owes them champagne and twenty-four hours a day prosperity all the days of their lives. It gives rise to a new idea of preparedness.

Out West, people have visions of hostile fleets standing off shore in safety beyond the range of our guns and battering a city to sure death. True to moving picture conceptions, our devices are imperfect, and it would be a poor story, indeed, if one of our shells hit the other fellow.

But the man in the East has another picture. It is of mills, brightening and lighting the sky at night. He believes in preparedness because it promises to overcome his dread of a reaction when the great war ceases.

In other words, his conception is that ships, artillery, ammunition and all munitions without end shall be ordered, not because we are going to be invaded, but because the overgrown steel mills must be kept busy.

However, I do not agree with this theory and still believe in preparedness in the way of ships, big guns, little guns, machine and others, and compulsory military drill.

In connection with this Eastern preparedness theory, I want to quote from Theodore N. Vail's speech at a dinner given by the California Railroad Commission at San Francisco, October 13, 1915:

"The trouble is not *overproduction*," he said. "It is *underconsumption*. Put the millions of men now idle or working temporarily on war materials at work permanently. Those now at work temporarily are not yet consumers in the big sense—they are paying off debts incurred or making good the savings spent during the idleness of last year or spring. Put them at work permanently in the upbuilding of our enterprises of utility and transportation.

"Establish rates that will make the investment in these enterprises so certain that the hundreds of millions of capital necessary for their extension and improvement will be forthcoming.

There is plenty of idle money as well as idle men. Put the money at work and turn it into productive labor. The spending of this money on constructive activities will put a good part of these millions of men at work—and those millions will start such *consumption* of all commodities as well as make work for all the others.

Instead of *over-production*, there will be *under-production* in all the workshops, orchards and fields of the country."

In the telephone business we have been troubled with underconsumption. What telephone company exists which does not have an actual waiting list? Let us ask for rates that will make the investment in extensions so certain that the capital necessary will be forthcoming. Let that be one version of proper preparedness.

Let the idle money be attracted so that every man who wants telephone service can have it. When every man has a telephone who actually needs it, the telephone industry will be singing the song of under-production.

It is within the power of every telephone company to make prosperity permanent. We must abolish $2 and $1 rates and work unceasingly toward rates which will make investment attractive, not only to yourself but to every investor.

Here is another striking paragraph from the Vail speech which calls for comment:

"What matters it if some roads do become far more prosperous than the average? It is necessary that others might live. There are and always will be, unequal conditions. Some roads can prosper and pay liberal dividends on rates which will hardly pay operating expenses of others. Natural inequalities cannot be regulated or controlled by man. Let natural and economic laws do that."

Put men in a new country, some prosper and others barely make a living. It cannot be prevented unless you kill prosperity altogether. We have plenty of examples. Even in nature big ears, little ears, high stalks and low stalks are found in the cornfield.

The Bell company prospers in spots and has trouble in others. Independents succeed at one place and fail in others.

The moral to the paragraph is that one swallow has never yet made a spring. Even success is a local issue.

As I finish, I am riding on a railroad which fell from a proud position to a most lowly and trying one. It became the butt of ridicule of a traveling public and even today when rehabilitation has come to it, public memory will not forget.

I refer to the Baltimore & Ohio, the aristocrat of railways and a bone of contention of the Civil War. Why it failed and others succeeded can probably be explained by the theory of natural inequalities.

It may explain why the Alton cannot succeed at $15,000 a mile while the Burlington, Santa Fe and others thrive on a gross earning of $10,000 a mile.

It is plain that no human agency, regulatory, governmental or otherwise, can bring about artificial conditions that will level conditions under which all operate.

The B & O is one hour late—it left the terminal late. It

would seem that a lack of efficiency, discipline, or pride of execution may account for its troubles. It goes to show that corporate, as well as personal troubles come from within, rarely from without. Every business you know of which came to an untimely end, did so by reason of internal diseases.

No telephone company will ever suffer from invasion. Its pangs come from laziness, fear, indifference, lack of faith and other bad habits of thought released by the inquisitive Pandora. Trouble never will come from outside causes.

MORAL: Eternal vigilance is the price of liberty.

Meeting of Home Progressive Club, of Russellville, Ky.

A recent meeting of the Home Progressive Club, of the Russellville (Ky.) Home Telephone Co., was featured by announcement from C. L. Obenchain, manager of the company, that there had been an increase of 15 per cent. in new business during the year 1915, while the increase in long distance tolls was 17 per cent. One of the important reasons for this excellent showing is the work done by the club, which is a voluntary organization of the operators and others connected with the plant. At this meeting B. Y. Chambers, assistant superintendent of the Central Home Telephone & Telegraph Co., of which the Russellville company is a part, presided and distributed the Central Home buttons among the operating force. Mr. Chambers addressed the members of the club and talks were made by various others.

This meeting was made the occasion for reading the individual New Year's resolutions the operators have made to govern their work during the year. One of these resolutions, showing the temper of them all, was as follows:

"That during the year 1916 I will endeavor to render the best service possible to each and every one of our subscribers, and to make friends of the patrons of the company."

"Safety First" Exhibit This Month.

There will be held in Washington, D. C., during the week of February 21-26 inclusive, a "Safety First" exhibit in which all of the government departments are taking an active part. This exhibit will take on a national aspect, as manufacturers and operators from all over the country are invited to be present, in order that they may see what the government of the United States is doing in "Safety First" work.

Secretary of the Interior Lane has sent a letter to the governor of each state inviting him to send a delegate, and asking that the chief mine inspector, a representative of the industrial commission, or of other agencies engaged in compiling statistics relating to the various mineral industries also attend this exhibition.

It is hoped that all interested persons will visit the "Safety First" exhibit, and will attend the conference of state mine inspectors, which will be held at the office of the Bureau of Mines, on February 24.

Meeting of Southern States Association at High Point, N. C.

The North Carolina district of the Southern States Independent Telephone Association will hold its first meeting at High Point, N. C., February 22, at the Elwood Hotel. This district is in the center of a large and prosperous Independent telephone development and preparations are being made to take care of 100 delegates.

The visitors will have an excellent opportunity to test the long distance lines of the Postal Telegraph-Cable Co. which terminate on the board of the North State Telephone Co., and to also inspect this company's modern instantaneous recall and automatic ringing and listening switchboard. All of the larger manufacturers will be represented with attractive exhibits. The Southern States association will be represented by Albert Parlett, president, and W. N. McAnge, Jr., secretary.

Program for Kansas Telephone Convention.

The Kansas Independent Telephone Association has decided to deviate from its former policy in confining its convention program to set speeches and has arranged to give its members and others attending the annual meeting of the association, to be held at the National Hotel, Topeka, on February 15, 16 and 17, something along practical lines, especially for the smaller companies, such as tests for different kinds of trouble, cable splicing, etc.

The program is in full as follows:

TUESDAY MORNING.

Registration.

Inspection of Exhibits on Sixth and Seventh Floors.

AFTERNOON SESSION.

Address of Welcome: J. E. House, Mayor of Topeka.

Response: J. D. Waters, Bonner Springs, Kan.

Report of Secretary.

Appointment of Committees.

"The Advantage of the Public Utilities Commission," by John M. Kinkel, member of Kansas Public Utilities Commission.

Practical Questions and Discussion by H. N. Faris and C. J. Myers.

Inspection of Exhibits on Sixth and Seventh Floors.

EVENING.

Theater Party. Guests of Topeka Commercial Club.

WEDNESDAY MORNING SESSION.

"Ideal Mutual Telephone Company," by Senator J. D. Joseph, Whitewater, Kan.

Practical Demonstration of How to Locate Trouble in Coils and Bad Joints: H. A. White.

Practical Questions and Answers.

AFTERNOON SESSION.

"Practical Methods of Locating Cable Trouble," by O. F. Tallman, St. Louis, Mo.

"Cable Splicing," by D. V. Taylor, Topeka, Kan.

Operators' School, conducted by Mrs. Alice Douglas, chief operator, Emporia, Kan., and H. E. Gwillim, traffic manager, Kansas City, Mo.

Practical Questions and Answers.

Smoker in the Commercial Club Rooms.

THURSDAY MORNING SESSION.

"Courts and Commissions Decisions," by E. H. Hogueland, Topeka, Kan.

Address by F. B. MacKinnon, Washington, D. C., third vice-president, United States Independent Telephone Association.

Report of Committees.

Election of Officers.

Adjournment.

A unique announcement in the form of a subpoena has been sent out to the members of the association "commanding" them to be present at the convention of the Kansas association. It reads as follows:

You are hereby commanded to be and appear before us, the undersigned, president and directors of the association, in said county, at the National Hotel, in said City of Topeka, on the 15th, 16th and 17th days of February, 1916, at 9 o'clock a. m., of the day first above mentioned, to testify on behalf of the association in an action there pending, wherein divers and sundry manufacturers of telephone apparatus are the defendants, being cited to show the telephone men of Kansas that they have goods worthy of serious consideration; and, further, divers and sundry prominent men of known learning and ability, have been called to testify; and further, there will be lots to eat and lots to cheer that does not inebriate; all of whom, which or what, have been made defendants.

Hereof fail not, at your peril.

This subpoena is signed by the officers and directors of the association.

Annual Reports and Meeting of Telephone Companies

Statements Issued by Telephone Companies in Various Parts of the Country Relative to Their Operations During the Past Year—Earnings and Surplus Accounts Show Companies to Be in Excellent Financial Condition—Election of Officers

Annual Meeting of Morrison (Ill.) Telephone Co.

At the annual meeting of the Morrison (Ill.) Telephone Co., General Manager F. Trautwein reported that at the close of the year 1915 the company had nearly 1,300 subscribers, an increase of about 30 per cent. over the previous year. During the past year the company rebuilt its entire system, including the erection of a new building and the installation of a complete cable system in the city of Morrison, at a cost of approximately $44,000.

The election of seven directors to serve one year was then held, those chosen being as follows: H. C. Allen, of Lyndon; J. S. Burns, of Fenton; R. S. James, J. H. Martin, E. A. Smith, J. A. Riordon and F. Trautwein, of Morrison.

Following the meeting of the stockholders the directors held a short meeting and organized the board with J. A. Riordon, president; H. C. Allen, vice-president, and F. Trautwein, secretary and treasurer and general manager.

Interior Telephone Co., Grinnell, Ia., Issues Report.

The Interior Telephone Co., which operates exchanges in Grinnell and Montezuma, Iowa, has just issued a detailed statement of its receipts and disbursements during the year 1915 and balance sheet as of January 1, 1916. The company's gross revenue for the year just completed ($33,672), includes $33,354 operating revenue and $318 non-operating revenue. The operating expenses were $25,940, which together with the non-operating expenses, totaled $30,996, leaving a surplus of $2,676 for the year. The total assets on January 1, 1915, were $95,514, while on January 1, 1916, they amounted to $102,384, an increase of $6,870.

During the past year the company has sold its 6 per cent. preferred stock to the amount of $3,425 and $3,000 has been borrowed on short time paper. The proceeds of these funds have been used (a) in the purchase for $1,650 of the Mutual Telephone Co.'s plant at Montezuma and (b) in important additions and extensions to both the Grinnell and Montezuma plants.

The company's statement of receipts and disbursements follows:

RECEIPTS.

Exchange service revenues		$29,057
Toll service revenues		2,618
Miscellaneous operating revenues		1,679
Total operating revenues		$33,354
Non-operating revenues		318
Total revenues		$33,672

DISBURSEMENTS.

Maintenance expense	$13,388	
Traffic expense	7,779	
Commercial expense	1,291	
General office salaries	1,990	
General office supplies and expenses	516	
Insurance	598	
Accidents and damages	27	
Law expenses connected with damages	8	
Miscellaneous general expenses	343	
Total operating expenses	$25,940	
Uncollectible operating revenues charged off	110	
Taxes assignable to operation	984	
Rent for telephone offices	1,525	
Interest deductions for funded debt	1,836	
Other interest deductions	601	
Surplus	2,676	
		$33,672

The balance sheet of the Interior Telephone Co., as of January 1, 1916, follows:

ASSETS.

Plant:			
Fixed capital installed prior to Jan. 1, 1914	$ 76,276		
Land and buildings	14,750		
Central office equipment	836		
Station equipment	2,632		
Exchange lines	4,142		
Exchange underground	1,993		
General equipment	529		
Office furniture and fixtures	1,713		
Total	$102,871		
Reserve for accrued depreciation	8,017		
			$94,854
Working Assets:			
Cash in banks	$ 2,596		
Employes' working funds	91		
Rental accounts due	1,411		
Toll accounts due	978		
Sundry accounts due	45		
			$ 5,121
Deferred Debit Items:			
Provident fund assets	$ 2,100		
Prepaid insurance	208		
Prepaid directory expense	24		
Other prepayments	77		
			$ 2,409
Grand total			$102,384

LIABILITIES.

Stock:			
Common stock	$ 23,425		
Preferred stock	28,025		
Service stock	1,200		
			$52,650
Long Term Debt:			
Funded debt (bonds)	$ 30,500		
Real estate mortgage, Grinnell	5,112		
Real estate mortgage, Montezuma	994		
			$36,606
Working Liabilities:			
Notes payable	$ 5,000		
Audited vouchers	604		
Pay roll	184		
Accounts payable, tolls, etc	666		
			$ 6,454
Accrued Liabilities Not Due:			
Taxes accrued	$ 238		
Interest accrued on bonds	457		
Interest accrued on notes	94		
Dividends accrued	1,282		
Water accrued	19		
			$ 2,090
Surplus			4,584
Grand total			$102,384

Northwestern Bell to Increase Capital Stock.

The directors of the Northwestern Telephone Exchange Co., of Minneapolis, Minn., have voted to increase the capital stock of the company from $15,000,000 to $25,000,000. This increase is to be used for additions and general improvements to the company's plants.

Increasing Business in Texas.

Most telephone companies in Texas report an increasing business during the latter part of 1915, with indications for a still heavier gain in 1916. Such reports are borne out conclusively by figures in the office of the state comptroller, taken from the payments made by telephone companies of the state for gross receipts taxes.

For the quarter ending December 31, 1915, the Southwestern Telegraph & Telephone Co. paid to the state, on January 25, $26,892.70 as gross receipts taxes. This company's receipts for those three months amounted to $1,792,847.19. The state comptroller's office announces that this is the largest gross receipts tax remittance received by the state since the law assessing such tax became effective in 1907.

The gross receipts tax in Texas is payable to the state by incorporated telephone companies, small or large, within 30 days after the end of each quarter, and amounts to one and one-half cents on each dollar of gross revenue. The tax is also assessed, in varying percentages, upon telegraph companies, electric light companies and some other corporations.

Annual Report of La Crosse Telephone Co.

The La Crosse Telephone Co., of La Crosse, Wis., has issued its comparative balance sheet as of December 31, 1915, and December 31, 1914, with its statement of income and expenses for the 12 months ended December 31, 1915, under the system of accounts prescribed by the Interstate Commerce Commission.

The total operating revenues are shown to be $90,014, and the total operating expenses $46,156, leaving net operating revenues of $43,858. Deductions of rent and interest leave a net operating income of $40,805. Non-operating revenues bring this sum up to $42,519. Making deductions for rents, interest and accrued depreciation, leaves a net income of $20,301. Of this sum $14,781 was used for dividends. Deducting $112 for adjustments, leaves a surplus for the year of $5,407. The comparative statement of income and expenses for the 12 months ending December 31, 1915, follows:

COMPARATIVE STATEMENT OF INCOME AND EXPENSES.

	1915		1914	
Operating Income				
Exchange service revenues	$86,199.71		$79,255.18	
Toll service revenues (net)	3,384.44		2,666.82	
Miscellaneous oper. revenues	429.39		419.65	
Total operating revenues		$90,014		$82,342
Operating Expense Accounts:				
Maintenance expenses	$15,004.99		$16,212.83	
Traffic expenses	14,472.15		13,040.80	
Commercial expenses	8,018.42		7,361.90	
General expenses	8,659.95		8,214.00	
Total operating expenses		$46,156		$44,830
Net operating revenues		$43,858		$37,512
Uncollectable operating revenues (expense)	$ 644.11		$ 685.82	
Taxes assignable to operations	2,408.75	2,053	2,250.50	2,936
Operating income		$40,805		$34,576
Non-Operating Revenues:				
Dividend revenues	$ 260.64		$ 260.64	
Interest revenues	582.00		582.00	
Miscellaneous	871.14		412.79	
Total non-oper. revenues		$ 1,714		1,255
Gross income		$42,519		$35,831
Deductions from Gross Income:				
Rents	$ 1,598.93		$ 738.52	
Interest	1,705.88		1,833.61	
Reserve for accrued depreciation	18,913.44	22,218	17,359.20	19,931
Net income		$20,301		$15,900
Disposition of Net Income:				
Dividend appropriations of income	$14,781.28		$13,960.78	
Miscellaneous appropriations of income	None	$14,781	143.81	14,105
Surplus		$ 5,520		$ 1,795
Adjustments		112		145
Net surplus for year		$ 5,408		$ 1,650

The balance sheet of the La Crosse Telephone Co., as of December 31, 1915, compares with the year, 1914, as follows:

ASSETS.	December 31, 1915.		December 31, 1914.	
Fixed capital installed (plant)	$329,116		$305,506	
Less reserve for accrued depreciation	107,696		90,991	
Net fixed capital installed	$221,420		$214,515	
Construction work in progress	218		32	
Investment securities (other telephone stocks and bonds)	11,795		11,795	
Working Assets:				
Cash	$4,552.10		$1,063.43	
Employes' working funds	21.00		21.00	
Bill receivable	1,700.00		1,700.00	
Due from subscribers, exchange	1,782.89		1,845.17	
Due from subscribers, toll system	19.44		41.95	
Miscellaneous accounts receivable	2,278.03		4,619.88	
Materials and supplies	8,280.46		6,616.08	
		18,632		15,308
Deferred Debit Items:				
Prepaid insurance	$ 173.55		$ 122.44	
Prepaid directory expense	176.35		163.53	
Other prepayments	15.16		205.48	
		365		491
Total assets		$252,430		$242,141
LIABILITIES.				
Common stock issued	$ 50,000		$ 50,000	
Preferred stock issued	157,200		150,000	
Working Liabilities:				
Bills payable	26,000		28,968	
Accrued Liabilities:				
Taxes, interest and miscellaneous	2,436		2,259	
Deferred Credit Items:				
Employes' compensation reserve	1,633		1,160	
Corporate surplus unappropriated	15,161		9,753	
Total liabilities	$252,430		$242,141	

The total number of telephones connected to the company's system on December 31, 1915, was 6,118, an increase of 423 over the preceding year.

Annual Meeting of Lincoln Telephone & Telegraph Co.

The annual report of General Manager L. E. Hurtz, of the Lincoln Telephone & Telegraph Co., presented at the annual stockholders' meeting, showed that the company operates in 22 counties in the state having a population in 1910 of 416,000. The Lincoln company operates 45,883 telephones and connecting companies 34,358.

The report showed that the company had increased the number of telephones in use each month from 57 in January to 559 in April, a total net gain for the year of 2,628. The gain by purchase of other companies was 572 and the loss through sale to other companies was 80, leaving a net gain for the year of 3,120, or approximately 7 per cent. The company operates 88 exchanges, and has a wire mileage of 103,000, with a pole mileage of 10,292. Eighty miles of wires are underground. There are 126 exchanges in the territory that are operated by 74 competing and connecting companies.

Mr. Hurtz pointed out as proof of the character of the service the company is rendering that in the last four years but one competing company has entered the field and it took away only 18 subscribers of the old company.

The gross revenues of the company for the year were $1,227,000, about $50,000 to $60,000 more than a year ago. The expense increased the same figure, a $100,000 sleet storm last spring being one of the big items of expense.

The following were elected members of the board of directors: S. H. Burnham, Frank H. Woods, Charles Mayer, Mark W. Woods, Joseph Grainger, Charles Stuart, George J. Woods, and C. J. Bills, of Lincoln, and C. N. Beaver and J. M. Bell, of York, and Christopher Clem, of Beaver Crossing.

Telephone Waves Demonstrated with Oscillograph.

The first public demonstration of the use of the oscillograph in connection with telephone circuits was made before a meeting of the Boston Section of the American Institute of Electrical Engineers, at the Franklin Union Hall, Boston, Mass., on January 14. About 700 persons were present and witnessed the recording on a screen of electrical waves conveying the inflections of the human voice, the notes of a graphophone and the pulsations of the surf over a 5,000-mile line of the American Telephone & Telegraph Co.'s system, extending from San Francisco via Portland, Ore. Owing to a blizzard west of Reno, Nev., the line had to be looped 1,500 miles further through Portland, Ore., but the demonstration was entirely successful notwithstanding this condition.

The oscillograph, which is a combination of sensitive galvanometers having a minute mirror, which is suspended on a fiber, was connected in on the telephone circuit. A beam of light reflected by the mirror from an electric lamp was reflected in turn on an eight-sided revolving mirror, from which it was reflected on the screen. By this means two motions were procured, which reproduced the varying sound waves in remarkable forms. A special telephone transmitter had been mounted at the rocky shore of the Pacific Ocean, near the Cliff House, and the beat of the waves was clearly reproduced through the oscillograph. Music was likewise reproduced in electric waves.

Members present were provided with individual telephone receivers, and heard the sounds produced at the other end of the line, which at the same time were recorded through the oscillograph. H. G. Bates, commercial representative of the Pacific Telephone & Telegraph Co., spoke from the general office of the company in San Francisco, and later the line was connected with the meeting place of the New York meeting of the institute, whence Michael I. Pupin, inventor of the loading coil, and John J. Carty, chief engineer of the American Telephone & Telegraph Co., spoke to the Boston audience.

Practical demonstrations on the oscillograph were made with electric bells, automobile horns and music, and photographs were taken of the waves produced.

Telephone Gains in Chicago Suburban Districts.

A record of the impulse of prosperity may be found in the increased use of the telephone in the suburban territory tributary to Chicago. In the ten counties of Illinois and Indiana served by the Chicago Telephone Co. 92,000 subscribers are in touch with their neighbors and the markets of the world by means of the telephone. This is an increase of over 5,800 in the last year.

In carrying out its policy of keeping in advance of telephone growth, the Chicago Telephone Co. spent thousands of dollars during 1915, adding many miles of aerial and underground cable, rebuilding and repairing telephone exchanges and installing additional switchboards.

Since August, the company has put in service in its suburban field sixteen auto trucks for use in construction work, practically displacing the horse as a factor in its construction and maintenance department. In its city and suburban territory combined, the company now has over 200 motor-driven vehicles in use.

A large part of the new work in the suburban territory has had for its object the extension of toll facilities and for this purpose many miles of additional aerial and underground cable have been installed.

Many cities now have telephone communication with Chicago through underground conduit, which insures the service against interruptions that might result from sleet storms, high winds or from the work of vandals or petty thieves.

Extensions of this underground system are now under way, some of the more important of which are for the purpose of ultimately placing cities in Kane and Will counties in underground communication with one another and with Chicago.

While the increase in the number of telephones in the suburban district has been general, telephone expansion has been more marked in the larger places. The Oak Park district now has 995 more telephones than were in service on January 1, 1915. The Evanston district had an increase of 985 telephones during the year. In the Aurora district 495 subscribers were gained. The Joliet district enjoyed a growth of 609 telephones. In the Calumet manufacturing district, to the south and east of Chicago, steady telephone gains have marked the revival of business during the last few months.

The increasing general demand for a higher grade of service throughout the company's suburban territory is shown by a larger gain in the number of two-party-line telephones as against a smaller increase in four-party-line telephones.

New Automatic Plant Cut in Service at Youngstown, Ohio.

The Ohio State Telephone Co. on Saturday evening, January 29, cut over its manual telephone system in Youngstown, Ohio, to the new automatic plant on East Rayen avenue, "girl-less" telephones displacing 3,200 manual instruments. The installation of the new plant represents an investment of $750,000.

The cut over was witnessed by a number of officials of the Ohio State company, including George G. King, manager of the Youngstown exchange; B. H. Brooks, chief engineer of the Ohio State company; Martin Purdue, assistant chief engineer; J. E. Elwell, traffic manager; M. B. Evans, operating engineer; J. D. Kratz, maintenance expert; M. J. Beaton, maintenance supervisor of the Akron, Columbus and Alliance branches; W. M. Tune, equipment expert from Columbus; D. G. Raley, general manager of the Salem district; C. H. Swift, general manager of the Alliance system; R. R. Stevens, commercial superintendent of the company, and C. J. Queen, general manager of the Akron system.

Plan of Loaning Money to Employes Without Interest.

Announcement was made by the Texas headquarters of the Southwestern Telegraph & Telephone Co., in Dallas, January 28, that the company will soon inaugurate a system of lending money without interest to employes. The loan department, according to Ben S. Read, second vice-president, will be handled as an extension of the company's pension, disability and death benefits.

The size of the loans will be governed by the character of the service in which the employe is engaged, and how grave his financial stress may be. Employes will be permitted to repay sums so borrowed in amounts and at times to suit the employe's convenience and ability to pay.

"By furnishing financial aid to our employes," said Mr. Read, "we hope to make them independent of persons who make a practice of profiting off of men and women who borrow money on short time at most unreasonable rates of interest."

Kansas Mutual Companies to Hold Convention.

The Kansas Association of Mutual Telephone Companies will hold its annual convention at Manhattan, Kan., on February 21 and 22 and it is expected that 100 representatives of mutual companies from all sections of the state will be in attendance. J. D. Shields, of Lost Springs, is president of the association; C. W. Swallow, of Minneapolis, Kan., vice-president, and M. H. Rize, secretary-treasurer.

San Diego Home Installs 430 Telephones in Six Months.

The rehabilitation and extension of the San Diego Home Telephone Co. system in San Diego, Cal., has resulted in an increase from 5,270 telephones installed to 5,700, within the last six months, according to an official report.

Proceedings Before Commissions, Courts and Councils

Discussions and Rulings of State Bodies Having Supervision Over Telephone Companies, Decisions of Courts in Matters of Interest to Public Utilities and Actions of City Councils Relative to Franchises, Rates and Service

Valuing Property Incident to Merger in Ohio.

The Ohio Public Utilities Commission recently presented to E. C. Turner, state attorney general, a statement of facts and inquiry relative to the joint application of the Home Telephone Co. of Ironton, and the Central Union Telephone Co. for the sale of the local exchange of the latter company to the former. The letter of the commission states that as part consideration for the proposed sale and transfer, a traffic arrangement will be entered into whereby the Central Union company will connect with the exchange of the Home company, giving the subscribers access to all the lines and stations of the Central Union company.

As part of the purchase price the Central Union company is to receive $50,000 of the stock and $13,000 of the bonds of the Home company, the purchase price being $463,725. In approving the sale for the consideration named, the commission sought the opinion of the attorney general, as to whether it shall require the petitioning parties to comply with section 614-61, or only section 614-60, of the general code of Ohio. The same question, the commission states, was propounded to Attorney General Hogan on October 6, 1911, to which he replied on November 24. Mr. Hogan, in a letter to the commission, under date of November 29, 1911, qualified his opinion of November 24, stating that he was still investigating the question, and that he would later give the commission a rule for permanent guidance, in which condition the matter has been standing since that date.

In his reply to the commission the attorney general expressed the opinion that inasmuch as section 614-60 applies to physical connection only, section 614-60 is applicable to the question presented relative to the proposed merger in Ironton. The latter section, he interprets as meaning that the commission should ascertain and determine the valuation of the merged property and upon such valuation fix the rates to be charged.

It is urged by counsel for the Central Union company that there is nothing to be gained by requiring the appraisal and fixing rates as a necessary incident to the consummation of the transfer under consideration; that the rates may be investigated and fixed by the commission at any time. In the enactment of paragraph 4 of section 614-61, the attorney general states, the legislature evidently considered both of these questions, and decided that the time to fix the rate should be concurrent with the merger, and that by so fixing the rate at that time it eliminated the inducement to inject into the property fictitious values upon which a rate might be fixed.

The claim is also made that section 614-61 does not apply in this instance, because all of the property of the Central Union Telephone Co. is not being sold to the Home Telephone Co. of Ironton. By the sale under consideration, the Central Union Telephone Co. transfers to the Home company all of its telephone facilities in and within a radius of nine miles of Ironton, leaving the Home company the sole owner of all the telephone property in and within said territory. What were competing companies are now merged and under one ownership and control. So far as affecting the interests of the users of telephones in Ironton and within a radius of nine miles thereof, the attorney general held, it is unimportant as affecting the application of this section, whether or not the Central Union Telephone Co. may own other telephone property, and located elsewhere.

In concluding he expresses the opinion that the commission should proceed to ascertain and determine the valuation of the property in question, and to fix and determine the rates, tolls, charges and rentals, so to be charged by the Home Telephone Co. of Ironton.

Hearing on Telephone Investigation in Washington.

Hearing on the investigation of the operations of the Pacific Telephone & Telegraph Co. in the state of Washington was resumed at Tacoma on Monday, January 31. The first witness called upon was F. H. Leggett, Pacific district manager of the Western Electric Co., who told of the relations of the American Telephone & Telegraph Co. with his company. Mr. Leggett said that the American Telephone & Telegraph Co. owns 96 per cent. of the stock of the Western Electric Co. The Western company, he said, acts as the purchasing and storekeeping department of the telephone company, supplying all associated telephone companies with equipment and supplies at a standard price.

Mr. Leggett was brought from San Francisco to substantiate statements of the telephone company's engineers that the reproduction of the present plant of the company in this state would put such a load on the manufacturers' equipment that the price would have to be higher than in a normal construction period. He said one heavy item of expense would be the overtime for labor. Telephone material, he said, is ordered by the associated companies sometimes two and three years in advance, and a definite program of the quantity of equipment to be manufactured is mapped out each year. Any extra load, he said, would disrupt the working program.

Assistant Attorney General Henderson, cross-examining Mr. Leggett, attempted to get specific information regarding the cost of telephone poles, an item on which engineers for the company and commission differ widely. Mr. Leggett said the Western Electric Co. has a contract with the National Pole Co. to supply all the poles normally needed. He was unable to answer Attorney Henderson's question as to how many there are and how much profit must be taken out of each pole in the transaction from the owner of the stumpage to its place in the telephone system. He said there is a wide difference in the price of poles, according to conditions under which they are procured. People who own the stumpage, he said, set the price, and "when they scent a big demand, the price goes up."

Mr. Leggett said "standard prices" on equipment are made only to "associated companies" by the Western Electric Co. Independent companies, he said, cannot obtain those prices unless an associated company recommends it.

Commissioner Reynolds asked if the contracts between the Western Electric Co. and the associated telephone companies are not merely a matter of form, a sort of taking money out of one pocket and putting it in the other. Mr. Leggett replied that he did not think so. He said the mere fact that a company has a supply contract with the Western Electric Co. does not necessarily indicate that it gets better process than a non-associated company. He cited the instance of the Bell company of Missouri, which canceled a contract with the Western Electric Co. and bought supplies in the open market. On competitive bids, he said, the

Missouri company paid about 7 per cent. more than it did the year before, when purchasing through the contract with the Western Electric Co.

Discrepancies between the estimates of the telephone company's engineers and those employed by the public service commission again interfered with the progress of the hearing, and it was agreed to give the engineers the following day, February 1, for a conference to reconcile the differences, if possible, for which time the commission would take a recess.

In the accompanying reproduction of a photograph of those present at the hearing last week, the names, from left to right, in the top row, are: C. H. Judson, engineer of the Pacific Telephone & Telegraph Co.; N. R. Powley, rate engineer of the Pacific company; A. N. Hall and R. Z. Young, engineers of the Pacific company; A. E. Boyles, engineer of the commission; John King, president of the Puyallup Telephone Co.; Scott Z. Henderson, assistant attorney general; F. S. Burroughs, engineer for cities; A. B. Matton, visitor; W. H. Gillespie, superintendent of supplies of the Pacific company; S. T. Rodgers, R. C. Barton and O. E. Blank, engineers of the Pacific company, and N. W. Bolster, reporter. In the front row it will be noticed that the commissioners are standing just a trifle ahead of the rest of the party. Those in the front row are, from left to right, as follows: Otto B. Rupp and James T. Shaw, attorneys for the Pacific Telephone & Telegraph Co.; H. D. Pillsbury, vice-president and general attorney of the Pacific company; J. C. Nowell, general manager of the Pacific company; A. H. Griswold, plant engineer of the Pacific company; A. A. Lewis, commisioner; F. R. Spinning, commissioner; C. B. Reynolds, commissioner and chairman; L. B. Kaler, official reporter; W. D. Maare, division superintendent of plant of the Pacific company; E. G. Sills, engineer of the Pacific company; W. B. Scott, equipment engineer; J. S. Simpson, accountant of the commission, and A. E. Rotchford, stenographer of the commission.

Those at the Hearing in Tacoma in the Investigation of Pacific Telephone & Telegraph Co. by the Washington Commission.

Ordinance for Sale of Chicago Automatic System.

A minority report of the council committee on gas, oil and electric light was presented to the Chicago city council last week. It bore the signatures of Aldermen Merriam, Buck and Kearns and recommended that the proposed ordinance allowing the sale of the automatic telephone system owned by the Illinois Telephone & Telegraph Co. to the Chicago Telephone Co. be placed on file.

The report condemns the compensation of $500,000 which the city will receive for allowing the sale in the event the ordinance passes. It likewise condemns the failure of the committee to include a referendum clause in the ordinance. It says with regard to Walter L. Fisher, who acted as Mayor Thompson's special attorney in the proceedings:

"Mr. Fisher also rendered an opinion upon the rights of the city to forfeit the telephone rights and property of the company. He did not reach, however, any definite conclusion."

The three dissenting aldermen likewise base their request that the ordinance be filed upon the fact that if passed by the council future contracts between the city and public utilities would be worthless, inasmuch as the automatic company failed of its contract and suffered nothing. The report states:

"Indeed, the attorney for the company (Mr. Ettelson), finally became the chief law officer of the city."

Alderman Merriam has consistently held that the city should forfeit both the rights and property of the automatic company because of its failure to live up to its contract.

Citizens Company Wins Suit at Cadillac, Mich.

Judge Fred S. Lamb, at Cadillac, Mich., recently dismissed the suit of the City of Cadillac to restrain the Citizens Telephone Co. from raising its rates, declaring that the "city had not established any cause for complaint, either in law or in fact."

The company in 1913 raised its rates to $18. The city secured a temporary injunction restraining the company from increasing the rate, declaring that it had an agreement with Henry Sill, who established the telephone system in the city, to the effect that the rate should never be higher than $15. The company said it knew nothing of the agreement and was bound to comply only with regulations of the state railway commission.

Valuation of Peoria, Ill., Plant of Central Union.

The valuation of the Peoria, Ill., exchange of the Central Union Telephone Co., according to figures recently filed with the public utilities commission, is fixed at $1,156,299, while the reproduction value is placed at $1,337,555. This valuation was prepared by the telephone company to combat the city council's demand for a lowering of rates. The cost of preparing the inventory, the company states, was $15,000.

Telephone Company Must Pay Franchise Tax.

The South Dakota Supreme Court has ruled in favor of the city of Mitchell in its dispute with the Dakota Central

Telephone Co. relative to a franchise tax. The original franchise to the company required a payment of a portion of the gross proceeds of business to the city. When the law was passed taking franchises in lieu of all other taxes, the company declined to make further payments on the ground that such was a tax. The court holds its franchise contract is for the use of the streets and alleys, and not a tax, and must be paid.

Physical Connection Ordered in the Town of Auxvasse, Mo.

The Missouri Public Service Commission has rendered its decision in case 773, the Auxvasse Mutual Telephone Co. vs. the Buffum Telephone Co., ordering the companies to establish a physical connection for long distance service.

The Auxvasse Mutual company operates lines in the county and in the little town of Auxvasse and during the year 1915 filed a formal complaint with the commission, requesting that the Buffum Telephone Co. be ordered to furnish long distance telephone service to its subscribers.

The Buffum company has an exchange in Auxvasse and its subscribers are furnished long distance telephone service over the lines of the Bell company. A public hearing was ordered at Auxvasse and considerable evidence was introduced. The Buffum company's attorneys filed exhaustive briefs citing authority in contention of its refusal to furnish the long distance service to the Auxvasse Mutual company.

The commission, on February 8, issued an order to the effect that the Buffum Telephone Co. be ordered to construct and maintain a suitable and efficient physical connection with the switchboard of complainant and toll line of the defendant in Auxvasse, giving complainant connection with the defendant's long distance toll lines through the defendant's switchboard; that the cost of establishing this connection be paid by the Auxvasse Mutual Telephone Co., and that thereafter the Auxvasse Mutual company, its subscribers and the public using its lines are to pay the Buffum Telephone Co. the full amount of toll and charges, that the order is to be in effect March 1, 1916.

Franchise of Jamaica Telephone Co. Extended.

Negotiations between the Jamaica Telephone Co., Jamaica, West Indies, and the government have resulted in the extension of the company's franchise for 10 years.

From time to time suggestions have been made that the government should acquire the Kingston telephone plant. The company recognized that improvements were necessary, but as these would involve considerable expenditure, it would not undertake them unless its franchise were extended. The matter has now been settled, and the directors will take up the question of improvements shortly.

Complaint Against Telephone Company Dismissed.

The Wisconsin Railroad Commission, on February 4, dismissed the complaint against the Rice Lake & Northeastern Telephone Co. alleging inadequacy of service between Rice Lake and Kennedy. The commission finds that the Rice Lake exchange has been remodeled and that inasmuch as the line from Rice Lake to Kennedy is through a timbered country, the service is as good as the company can afford. It accordingly dismissed the complaint.

Columbia City, Ind., Physical Connection Case.

In regard to the case of the Whitley County Telephone Co. vs. Farmers Mutual Telephone Co. for free physical at Columbia City, Ind., about which an item was published on page 34 of last week's issue of TELEPHONY, General Manager R. R. Scott writes as follows:

"To do justice to ourselves and others we should endeavor to be fair in every transaction of life. I feel that the report of our case before the Indiana commission as given in the issue of TELEPHONY of February 5 might do us an injustice and place us in the wrong light.

"We are *not* opposed to a physical connection on a fair, just, and equitable basis—in fact, we made a verbal proposition before action was taken, to connect the exchanges on a 5-cent switching fee. But we are opposed to a *free physical connection* as petitioned for, when we can show that at best, we can make but from 3 per cent. to 4 per cent. on capital invested while the state has authorized the commission to allow from 6 per cent. to 8 per cent. on such investments. Besides we feel under conditions existing here, the greater benefit would enure to the Whitley County Telephone Co. and if its officers had not thought so themselves, they would not have petitioned for it."

Compensation for Switching Long Distance Calls.

The South Dakota Railroad Commission recently handed down its ruling in the case of the Dakota Central Telephone Co. vs. the Conde (S. D.) Telephone Co. in the matter of compensation for switching toll calls. The Conde company has been demanding a payment of $30 per month regardless of the volume of business transacted, and it is now ordered to make a contract for switching on the basis of five cents each for incoming and outgoing toll messages and two cents for switching through business.

Competing Telephone Companies.

Section 614—52 of the general code of Ohio applies to the telephone companies defined in previous sections of the code, whether such companies are organized for profit or not, where the entrance of the second company substantially affects the public convenience. In such case a certificate must be secured to the effect that the exercise of the right of franchise is proper and necessary for the public convenience. Ashley Tri-County Mutual Telephone Co. vs. New Ashley Telephone Co., Supreme Court of Ohio; 110 Northeastern, 959.

Injuries from Maintenance of Wires.

Where the defendant telephone company maintained wires across the premises of plaintiff's father at a distance of 11 or 12 feet from the ground, such father, having ridden under such wires on a load of hay only once previously to his death. from being scraped off such a load, on which he was riding, by such wires, was not contributorily negligent in so riding on the load, although he knew that the wires were low, and that he would be required to stoop to escape them. Bonjour vs. Iowa Telephone Co., Supreme Court of Iowa; 155 Northwestern, 286.

Partnership in Telephone Line.

Where three persons constructed a telephone line as a joint venture, and two of them became stockholders of a corporation which absorbed their interest and operated other lines, but the third retained his interest and did not become a stockholder of the corporation, his assignee was entitled to an undivided one-third interest in the line, subject to payment of his ratable share of the operating expenses. Salem-Fairfield Telephone Association vs. McMahan, Supreme Court of Oregon; 153 Pacific, 788.

Discontinuance of Service.

Where, in proceedings before the public utilities commission to compel a telephone company to restore telephone service to complainant's residence, it appeared that the company had agreed to string a wire from its line to such residence on poles to be erected and maintained by complainant and to furnish service over such wire, that for several years it had complied with this agreement, that one of the poles, having been cut

down, interfered with the defendant's service, and that defendant cut the wires and discontinued the service to complainant's residence, that thereafter a company to which complainant had given a right to also use the poles, providing it kept them in repair and renewed them, renewed the pole and restored the line, but that defendant refused to restore its former service, the commission, acting under authority expressly conferred on it by the general code of Ohio, section 614—12, added by 102 Ohio laws, page 553, properly directed the defendant to restore the service pursuant to the agreement, at rates and on terms stated and deemed by the commission to be just and reasonable until the publication and filing of a proper schedule in conformity with law. Valley Telephone Co. vs. Ohio Public Utilities Commission, Supreme Court of Ohio; 110 Northeastern, 958.

Summary of State Commission Hearings and Rulings.

CALIFORNIA.

January 30: The Klamath Telephone & Telegraph Co. and the Siskiyou Telephone Co. filed an application for authority for the former company to convey to the Siskiyou company about 140 miles of telephone wire and equipment lying to the west and south of Yreka. The sum to be paid is $6,000.

February: Application filed by the Empire Telephone Co., of Empire, Stanislaus county, for authority to issue a certificate of common stock at a par value of $35 to each of 38 persons who have paid the corporation that sum.

February: Order authorizing the Santa Paula Home Telephone Co. to buy the property of the Pacific Telephone & Telegraph Co. in Santa Paula, Ventura county, for $25,000 and to issue to the latter company its two-year note for this sum at 6 per cent.

COLORADO.

February 14: Continued hearing on state-wide investigation, upon the commission's own motion, of the Mountain States Telephone & Telegraph Co. with a view of determining the reasonableness of its rates, regulations, etc.

ILLINOIS.

February 3: Agreement between the Cumberland Telephone & Telegraph Co., and the White County Telephone Union, of Carmi, to operate their lines in connection with each other, approved.

February 8: Hearing on the petition of the Northern Illinois Telephone Co. vs. the Farmers' Telephone Co., of Sandwich, for an order restraining the respondent company from erecting new telephone lines along the lines of the petitioner in DeKalb county near Sandwich, LaSalle and Lee counties.

February 8: Hearing on complaint of the Northern Illinois Telephone Co. vs. the Inter-Township Telephone Co., asking that the respondent telephone company be restrained from erecting telephone lines along the line and in the same territory as the complainant company in LaSalle, DeKalb and Lee counties.

February 8: Hearing on complaint of Frank B. Fulton vs. the Chicago Telephone Co., on an overcharge for telephone service at Kenwood Hotel, Chicago.

February 8: Application filed by the Chicago Telephone Co. for the approval of a stock issue of $3,000,000, to be expended in extensions and betterments.

February 15: Hearing in the case of the City of Peoria vs. the Central Union Telephone Co., alleging excessive rates.

February 23: Continued hearing on the joint application of the Central Union Telephone Co. and the Decatur (Ill.) Home Telephone Co. for the purchase of the Decatur Home company by the receivers of the Central Union. The hearing was continued to permit further conferences between the various parties interested in the establishing of satisfactory toll contracts.

INDIANA.

March 1: Postponed hearing on the complaint of the Martinsville (Ind.) Chamber of Commerce against the Martinsville Telephone Co., alleging poor service.

March 8: Hearing on petition for approval of the merger of the New Long Distance Telephone Co., the New Telephone Co. and the Indianapolis Telephone Co., of Indianapolis, Ind.

IOWA.

February 1: Protest filed by the Jefferson County Telephone Co. against the granting of franchises to R. M. Burtis for the construction of transmission lines from Fairfield to Batavia and Fairfield to Birmingham, on the ground that the electric line will destroy the usefulness of the telephone lines in that section.

KANSAS.

January 25: Hearing on complaint of Dr. Paul V. Annadown, Harry Roberts and others against the Centralia (Kan.) Telephone Co., alleging poor service.

February 10: Hearing on application of the American Independent Telephone Co., of Holton, Kan., for permission to abrogate certain contracts. Case No. 1118.

February 10: Hearing on application of the American Independent Telephone Co., of Holton, Kan., for permission to discontinue free service with certain exchanges. Case No. 1119.

February 24: Hearing on application of the Missouri & Kansas Telephone Co. for authority to change rates in the city of Wellington, Kan. Case No. 1153.

MICHIGAN.

March 1: Final hearing of the Michigan State Telephone Co.'s application for metered rates in the Detroit metropolitan zone.

MINNESOTA.

February 8: Hearing in the case of the Fulda (Minn.) Telephone Co. vs. the Northwestern Telephone Exchange Co., relative to terminal charges.

MISSOURI.

February 8: The commission ordered the Buffum Telephone Co., of Auxvasse to establish physical connection with the Auxvasse Mutual Telephone Co. for long distance service. Case 773.

NEBRASKA.

February 16: Hearing on application of the Tri-State Telephone Co., of Chadron, Neb., for permission to issue $150,000 of stock and $75,000 of bonds.

February 25: Postponed hearing on the application of the Lincoln Telephone & Telegraph Co. for permission to increase its farm line rate at Wahoo, Neb., from $1 to $1.25.

NEW YORK.

February 8: Hearing of complaint of William Jagels, of Stuyvesant, Columbia county, against the Valatie Telephone Co., alleging too many subscribers on the lines used by him.

PENNSYLVANIA.

January: Joint application filed by the Cumberland Valley Telephone Co., of Harrisburg, Pa., and the Eastern Perry Telephone Co. for the sale of the properties of the latter company to the former for $10,025. The lines of the Eastern Perry company extend from West Fairview through Marysville, Duncannon, New Buffalo and Montgomery's Ferry.

January 29: Hearing on application of the Cumberland Valley Telephone Co., of Harrisburg, Pa., for authority to connect with the Perry County Telephone & Telegraph Co.'s exchange at Newport.

WISCONSIN.

February: Application filed by the Baldwin Mills Telephone Co., of Waupaca county, for permission to increase its rates.

February 3: Hearing on application of the Glidden (Wis.) Telephone Co. for permission to increase rates. U—870.

February 4: The commission dismissed the complaint against the Rice Lake & Northeastern Telephone Co., alleging inadequacy of service between Rice Lake and Kennedy. The commission finds that the Rice Lake exchange has been remodeled and that inasmuch as the line from Rice Lake to Kennedy is through a timbered country, the service is as good as the company can afford.

February 10: Hearing on application of Feeley's Pike Lake Telephone Co., of Fifield, Wis., for authority to increase rates. U—874.

February 12: Hearing in the case of E. W. Posselt, et al., vs. the Larsen Telephone Co., and the Readfield Telephone Co., relative to physical connection. U—872.

February 15: Hearing on application of the Union Telephone Co. and the Western Crawford Telephone Co. for permission to increase rates. U—879.

February 18: Hearing on application of J. E. Baker, et al. for an order requiring physical connection between the Cadott Telephone Co. and the Wisconsin Telephone Co., at Stanley, Wis. U—876.

February 18: Hearing at Fall River in the case of P. J. Girard, et al., vs. the Peoples Telephone Co. U—875.

February 24: Hearing on application of the Beef River Valley Telephone Co. for authority to increase rates. U—880.

February 25: Hearing in the case of the Rosendale Telephone Co. vs. the Wisconsin Telephone Co. as to rates and service. U—708.

February 29: Hearing on application of Baldwin's Mills Telephone Co. for permission to increase rates. U—881.

February 29: Hearing in the case of the City of Lancaster vs. the Wisconsin Telephone Co. and the Farmers Telephone Co., relative to physical connection. U—871.

WASHINGTON.

January 31: Continued hearing at Tacoma on the investigation of the Pacific Telephone & Telegraph Co. with a view to establish a fair value upon which to base rates.

Fundamental Principles of the Telephone Business

A Reading Course Designed to Present Logically the Principles Which Underlie Successful Organization and Operation of Telephone Properties—Prepared Under the General Supervision of Stanley R. Edwards—Part I, Telephone Economics, by James H. Shoemaker, Completed June 26, 1915—Part II, The Corporate Telephone Organization, by J. C. Kelsey and S. R. Edwards, Completed September 25, 1915—Part III, Telephone Accounting and Auditing, by James H. Shoemaker, Completed January 15, 1916—Installments Now Being Presented Comprise Part IV, Telephone Finance, Written by J. C. Kelsey and S. R. Edwards

Quiz Questions on the Preceding Installment.

1. How do standards enter into our every-day life?
2. Define "owned" capital. What is included in the term "borrowed" capital?
3. Give some examples of telephone corporations which are in the owned capital class.
4. What are the general sources of borrowed capital?
5. Who comprise the active interests of a corporation? Do they supply any part of the corporate funds?
6. Discuss the profits of a company as a source of funds.
7. How were many of the extensions to facilities required by many telephone companies financed? Why was this method used?
8. How have Independent manufacturing companies aided telephone companies?
9. Illustrate by example how a creditor supplies funds to an operating company.
10. What is the primary object of banks?
11. Who comprise the class known as "the investing public?"
12. What group classifications are made of that part of the public, known as the speculative class, from which funds are obtained?

CHAPTER II. The Borrowed Funds.

13. *Investment and Speculation.*—One year ago Gansey R. Johnston, vice-president and general manager of the Ohio State Telephone Co., speaking before the national telephone convention, stated that telephone properties have passed beyond the speculative stage and are now on an investment basis.

An investment basis means that a security will not depreciate in value to an appreciable extent. A government bond is usually spoken of as an investment, yet both American as well as English bonds have undergone fluctuations of late years. Investment in industrial bonds is called semi-investment because possible competition or new invention may hurt the business.

As a matter of fact, everything in the world's security market can depreciate, so that the line between speculative and investment securities must be more or less guesswork.

As ordinarily interpreted, investment consists in exchanging money for property or securities, the value of which is so stable that the amount given for it may be obtained at a future time either through sale or redemption by the issuing company. There is also the requirement that a satisfactory and constant return for the use of the money be provided. Another factor is the assurance of a market so that the investment may be converted into money quickly and without difficulty.

In speculation, on the other hand, stability and constant return are not the principal factors. Money is exchanged for property with the purpose in mind to sell later at a great profit and this necessarily involves a risk, which is more or less great. What may be considered a speculation by one person is regarded as an investment by another. But the events of the last five years have shown that money exchanged for telephone securities cannot be classed as speculation. The telephone business shares in general prosperity and yet suffers less than others in hard times. Its income is thus stable and not fluctuating to any marked degree for it supplies a necessity.

14. *Advantage of Borrowing.*—Borrowing money is not a crime. It is said by William H. Lough, of the Alexander Hamilton Institute, that there is but one cheaper method than borrowing—it is known as stealing.

A corporation should borrow, occasionally, for no other purpose than to keep its credit in good working order. The richest man in Duluth, Minn., had a ten-year habit of stopping at a butcher shop to get the meat for dinner, which he paid for then and there. One evening he found he had no money and was rudely treated by the butcher for saying he would pay him the next day. He merely failed to keep a good credit in good running order—the daily payment of cash had only served to make the butcher suspicious of him.

To illustrate the advantage of borrowing money for conducting operations, suppose a company needs $100,000 for extensions and only 6 per cent., or $6,000, can be earned on the investment. A company could hardly hope to coax stockholders to buy stock on such a low basis. It would be better to sell $50,000 worth of 5 per cent. bonds and borrow $15,000 on notes at 6 per cent., making $65,000 with a fixed annual charge of $3,400. Then $35,000 of stock could be issued. This amount of stock would earn $2,600, or nearly 8 per cent., which would be worth while for the "owned" capital class to take the risk.

15. *Relation Between Borrowed and Owned Funds.*—Many years ago $65,000 of borrowed capital against $35,000 of owned capital would have been deemed frenzied finance. Today, successful business has demonstrated that $75,000 borrowed capital against $25,000 owned capital, cannot be considered improper financing.

To illustrate the use of borrowed capital, the balance sheets

of several telephone companies are presented. It is impossible to show exact percentages as the actual value of the assets undoubtedly differs considerably from the book value. The actual value is without doubt less than the book value owing to no figures being given for reserves for depreciation and also good will and franchise values which should, of course, be deducted from the assets. Stocks and bonds of other companies which were paid for in stock would also be deducted to obtain the actual funds. The balance sheets presented will, however, furnish an indication of the practice as regards borrowed funds.

16. *Illustrations of Balance Sheets Showing Borrowed Funds.*—Following is the balance sheet of a most successful Independent telephone company:

ASSETS.	
Plant, buildings, investments and receivables	$7,955,573
LIABILITIES.	
Capital stock	$3,000,000
Bonds	4,106,500
Accounts payable	89,240
Surplus	759,833
	$7,955,573

The borrowed funds, which are comprised of bonds and accounts payable, amount to $4,195,740 and form about 53 per cent. of the funds.

A successful Ohio Independent telephone company had the following balance sheet:

ASSETS.	
Plant, buildings and receivables	$446,395
LIABILITIES.	
Preferred stock	$ 94,000
Common stock	250,000
Payables	32,000
Surplus	70,395
	$446,395

The borrowed capital in this case is $32,000—the accounts payable being the only borrowings, no bonds having been issued. The borrowed funds are about 14 per cent. of the total funds. This company is a most conservative one.

The Bell telephone system had the following balance sheet for the same year as represented by the other sheets presented:

ASSETS.	
Plant, buildings, receivables, cash, stock and bonds	$924,260,818
LIABILITIES.	
Capital stock	$393,209,925
Funded debt	294,380,353
Payables	63,588,676
Surplus and reserves	173,081,864
	$924,260,818

The borrowings, in this instance, amount to $357,969,029 which is about 39 per cent. of the funds. The item of surplus includes a depreciation reserve which should be deducted from the amount of the assets as should also be the item of stock and bonds, amounting to $84,942,265, which has undoubtedly been paid for with stock in the parent company. These deductions would reduce the assets by approximately $135,000,000 and so that the borrowings would be practically 50 per cent. of the funds.

As previously stated these superficial examinations of the balance sheets are not accurate but they are sufficient to show the principle of borrowing and the tendency of telephone companies. The balance sheets in connection with the annual reports of the various telephone companies, which are published in TELEPHONY, furnish opportunity to make comparisons.

17. *Advantages of Owned Capital.*—There are numerous and excellent examples of sound financing in the telephone business. The Citizens Telephone Co., of Grand Rapids, Mich., had several million dollars of owned capital before it issued bonds. A bond issue of $400,000 was immediately oversold because the property represented by owned capital gave practically 10 to 1 security for the borrowed capital.

The New York Central railroad earned 10 per cent. in 1915 on its "owned" capital; while the Pennsylvania Railroad earned but 9 per cent. The New York Central has but 25 per cent. owned capital while the Pennsylvania has 66 2/3 per cent. The former, paying 4 and 5 and possibly 6 per cent. on borrowed capital naturally has more income available for the stock dividends. Yet the excess of New York Central bonds, having a relatively less security, makes it more dangerous for the stockholder in perilous financial times. The Pennsylvania stockholders possibly receive less in dividends, but the property, owing to the great margin of safety, would not be taken from them even in the most distressing financial disaster.

It is plain that a corporation which operates exclusively on owned capital in its early days, lays the better foundation for the future because it can offer better security when borrowing and consequently secure it at lower cost.

18. *Borrowing Not Bad Finance.*—The lesson to the telephone manager is that borrowing money is not bad finance, and that it is more likely to be to the advantage and profit of the stockholder than if the theory of exclusively owned capital is carried out. A study of the balance sheets of the telephone companies will indicate that the average of owned and borrowed capital comes close to a 50-50 basis.

19. *Distribution of Security Issues.*—The subject of borrowing money brings up the question as to what securities, or credit instruments, a corporation should put out. As has already been shown, there are four sources outside of the business which can be dealt with. They are: Trade creditors, banks, the investing public and speculative public.

Naturally, to trade creditors the corporation would offer bills and notes payable. To banks, notes payable and endorsed receivables could be offered. The investing public could be tendered bonds, or possibly preferred stock, if the bond market is bad. To the speculative public, nothing but stock could be offered.

20. *Basis for Amount of Securities.*—The amount of each security depends upon the assets and largely upon the earnings of the company. As a general rule, creditors pay more attention to the income account, for they have no desire to take the property. That is an operation which usually runs into great delay, court proceedings and other soul-wearing tendencies of settlement.

This tendency of investors reveals the fact that net earnings are the real criterion of credit and this in turn is an incentive to efficiency, economy and close management.

(To be Continued.)

Practical Subjects—Letters and Discussions

Cost of Making Valuations in Wisconsin.

Analysis of the cost of making valuations for the Wisconsin Railroad Commission of the physical property of certain telephone companies in the state operating local exchanges and also rural and toll lines has just been completed. It shows:

Name of Company	Number of subscribers	Miles of pole line	Reproduction cost new	Cost of making appraisal	Cost per dollar of investment	Cost per telephone connected	Cost per pole mile
A	465	132	$22,667	$111.43	$.00504	$.24	$.84
B	910	304.1	41,826	132.18	.00316	.146	.435
C	647	147.5	32,450	154.30	.00476	.24	1.04
D	1,766	347.9	81,650	360.00	.00442	.204	1.04
E	527	106.9	27,410	249.70	.0001	.473	2.34
F	1,059	210	55,933	526.36	.00942	.498	2.50
G	323	55.1	14,682	156.55	.0107	.485	2.75

A valuation and traffic study was made of the Milwaukee exchange of the Wisconsin Telephone Co. In this valuation the inventory was prepared by the telephone company and checked by the engineers of the railroad commission. The total number of telephones at the date of valuation was 36,153. The total cost of engineering service in connection with the valuation and study was $12,526, making a cost of 34.7 cents per connected telephone.

"Telephony's" Home Course for Telephone Men.

(Not meant for study.)

By Well Clay.

Minnesota,
Covered with snow;
Howling blizzard—
Thirty below.

FACTS.

Facts are not absolutely essential in poetry any more than they are in a horse trade. But when one can insert a few in either without detrimental results, it is well to do so, if one has any in stock. It pains me to observe that the above lines of verse contain real facts.

Facts are the most fixed thing in the world, once you get them that way, but they are very shy and one has to do considerable gunning to get a creditable mess—not that they are what you might call scarce. Far from it, for they belong to one of the largest families in the world, and one of the most stubborn also, if one must tell the truth.

A fact loves to skulk about in the background and does not voluntarily come out into the open unless one goes into the thickets after it. But once you have scratched your hide and torn your clothes in going through the thorny undergrowths of experience and have grabbed your fact by the nape of the neck (so to speak) and brought it home, that fact is going to be a regular boarder at your place right along and you will never have to make the second trip for it. Sometimes you get them in bunches but usually each one is a twin—once removed.

In hunting facts, one proceeds the same as with flees. You know they are present but it is hard to put your finger on an individual and isolate it; but real application and perseverance will work wonders.

Even then, very often, when one has captured what looks like a fact, a careful inspection by an expert will prove that it is not one of the true breed but only resembles the family in a general way.

Sometimes one of these near facts will travel and be generally accepted as a fact for a long time by people who are too indolent to strip it of its disguising appearances. But in the end someone will recognize it and advertise its spuriousness.

In trailing a fact to its lair one must be very careful not to confuse its tracks with the tracks of supposition and rumor, which often overlie and intermingle those of the game you are after.

We, who have been following more or less closely, the courses of "Home Study" so ably conducted through the columns of TELEPHONY the past year, must, by this time, have discovered that they are a pious fraud and not intended for the object set forth at all. They are nothing but a blind, gotten up to interest you in starting on a chase for facts about the telephone game. They are just facts, that's all—no romance, no harrowing details, no plot; nothing but unvarnished facts. That is not the worst feature either. We have got to *know* those facts in the telephone business in order that we may be *successful* and *stay* in the game. Isn't it awful the way modern business is taking the joy out of life?

Well, so long as we must prepare to associate from this on with facts, we might as well prepare to like them, or let on we do at any rate. And this is why I am writing this first chapter of a series (which will consist of at least two—if the editor does not catch on) about facts. Personally, on first acquaintance, I do not love facts at all, and some not at all what you might call excessive at any time. Still, with some facts I have got to be rather chummy and enjoy their company quite a bit.

It takes time to learn to distinguish between a Supposition and a Fact. And sometimes a Rumor will pass muster as either, f'r instance: When I started in the telephone business sixteen—or was it seventeen?—years ago there was a Supposition current at that time that vast fortunes were to be made in the telephone business on small capital. All one had to do, so this individual, Supposition, would say, was: "Get a franchise, set your poles, install your instruments, put your switchboard in a drug store"—and *there you were.*

In support of his veracity he would ask his friend Rumor, who boarded at the same hotel, to give his testimony. Rumor was a lively fellow who was pretty much in evidence about town and had traveled extensively. He would sail in and paint the business in such glowing colors that the inside of a sea shell would look like a fried egg in comparison.

I grew to love this pair of fellows like brothers and was never tired of hearing them hold forth. My only disquieting thought was that someone else might beat me to it. I never dreamed that I should have inquired into their antecedents and got a line on their standing but went into business with these two blatherskites posing as my benefactors.

They advised me to employ two of their friends to help me in the venture—said they had worked fine elsewhere and were very efficient and popular. I followed their advice like a numbskull, without going to the trouble of looking up their past record. These two guys were known as "Dollar a Month" and "Free Interchange of Messages."

One was to see about furnishing revenues and the other was to attend to popularizing the business and aid in getting new subscribers. I thought they were real *facts* and indeed they passed current as undisputed facts, belonging to the family of successful facts.

Things went fine for awhile and subscribers came in at a satisfying rate under the genial solicitations of Mr. Free Service, as we got to call him, so that Mr. Dollar a Month began to have hard sledding to make a showing. After we had been running about a year Rumor and Supposition came in occasionally and said that the telephone business always had paid large dividends elsewhere, so we must do likewise—said we really must in order to get capital to enlarge the business.

We had a few stockholders by then, in order that we might incorporate and have everything regular. We did not have

any actual cash in hand at the time but prospects were rosy for a great increase of business the next year. So we sold a few shares of stock and declared a nice juicy dividend. This did not matter much at the time, as I owned most of the stock and put the money back into new business at once.

About this time I had noticed frequently about the plant a quiet though cynical-looking chap and even had exchanged a few words with him on matters relating to the business, with which he seemed familiar. I did not know his name and, to tell the truth, I had not taken much of a shine to him at first, though afterwards he helped me out wonderfully.

This fellow, when asked regarding the dividend scheme advised against it and spoke in a very sarcastic vein about the qualifications of my two friends, Rumor and Supposition. However, before I learned his name, he disappeared temporarily, but he came back soon afterwards. Next week (if this sees the light) I will tell you further regarding the strange adventures of a novice in the telephone business and reveal to you the name of my new friend.

QUESTIONS FOR EXAMINATION.

Do not send in answers but hold a session with yourself in the storehouse or barn, going over them carefully before destroying.

What is a rumor? When is a supposition?

What relation is a rumor to a supposition?

What is their proper place in the balance sheet?

Which pleases stockholders most, a dividend or a supposition?

Does a banker loan money on rumors, or does he prefer facts?

Does a rumor ever look like a fact when investigated and closely scrutinized?

Does a patron take rumors or cash when he furnishes you with any material or labor?

Have you discovered any facts about your business and, if so, how do you like them?

(To be concluded.)

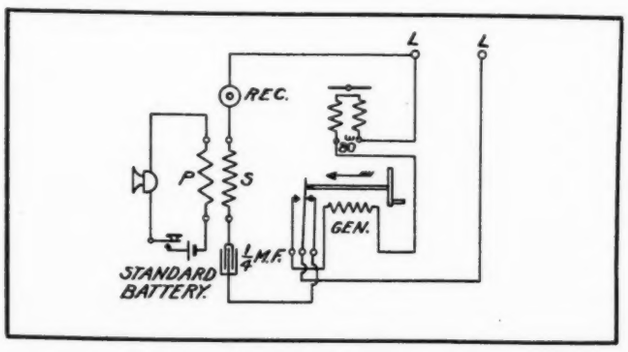
Test Set for Farmer Lines.

The accompanying drawing shows a circuit of a toll or farmer line test set that I find very satisfactory. By studying the arrangement of the different pieces of apparatus the set can be built to these dimensions: 8 ins. high, 5½ ins. wide and 4¾ ins. deep. It weighs 11 pounds.

The advantages of this test set are as follows:

The act of ringing changes the circuit from talking to ringing. Normally the talking circuit is on the line.

The troubleman can stay on the line all the time the wire chief is testing, because the ¼ m. f. condenser in



Circuit of Test Set.

series with secondary of the coil, does not interfere with either ringing or testing.

The troubleman has no switches to operate. All he needs to do is to ring and then press his battery button to talk.

Paris, Ill. Edward Ferris.

Some Operating Experiences and Suggestions.*

Last year the district convention was held in Higginsville, and our manager invited all the operators to make the convention a joint meeting between manager and operator. Going to telephone conventions was something new to all of us. Meeting people from the smaller towns all around us made it quite different from the "Ladies Aid Society," which was the only meeting most of us had ever attended. The men did the talking and the ladies listened, but they warned us that they did not intend to do all the talking at the next meeting. As the one great issue of the day is "Preparedness," we can say that we are in a measure prepared. However, our efforts may seem still in their infancy, for we have not been attending conventions long enough to know exactly how to tell much about what we do and what we know.

I am glad that I can be with you again this year, and the only regret is that we had to leave ten other operators at home. I am sure every one of them would have been benefited by this meeting. If conventions are helping the men better their part of telephone work, surely they will also help an operator, especially the one who has no opportunity to learn anything about her work save what she picks up in her own small office. I am certain every operator desires to be more efficient, and while it is impossible for all the operators to attend conventions and get new ideas, we who are fortunate enough to attend must watch and listen and learn just as much as we can, for our part is to go home and tell the other girls what can be done to better the service.

The operator, possibly more than any other employe of the company, should feel a personal interest in the company and her work, for it is she who comes into direct contact with the subscriber and it is through the operator that a company is first judged. So often it is the case that a remark or reply said in a short, snappy voice, sounds like a positive insult to an irate subscriber. He may say a few words to the operator, but he saves most of his wrath until he meets the manager, and the things he says then would not look well on paper. The manager possibly knows nothing whatever of the incident, but is blamed just the same. Certainly no operator wants another person to suffer for her mistakes; yet in this case that is what happened. Now if the operator had spoken in a pleasant tone, had explained that the ring in his ear had been accidental, had taken a little time to apologize, to make him feel that she had a personal interest in his call, the chances are that the next time he met the manager, he would have given him a glad handshake, assuring him that his service was fine, and his operators the best in the world.

I can cite a little incident in my own experience. A few mornings ago we were unusually busy and it seems that a farmer had to ring more than once to get central. As soon as I could, I answered him, and he asked very crossly: "Don't I ring in, central?" I replied, as it happened, in a very pleasant tone, "Yes, Mr. Jones, and so do a hundred others." I forgot all about the incident until a few days ago when I was talking to a friend. She told me about Mr. Jones having told her about calling central and speaking so cross, and when she answered him as she did, he realized how busy she probably was; so he hung up his receiver and went out and shoveled snow, making a vow that he never would be so cross to central again.

I have had a great deal of experience on the farmer board, and I am one of the few operators who really likes

*Paper presented by Mrs. Lulu Anderson, Higginsville, Mo., before the operators' meeting at the convention of the sixth district of the Missouri Telephone Association, Sedalia, Mo.

that board. One of the greatest drawbacks to good rural service is the long conversation on party lines. I have known people to hold a line an hour on one conversation, and I think there are occasions where central is justified in exercising some authority where parties refuse to give up a line.

One day I had a call from a subscriber who wanted to talk to his home in the country. I had a connection on the line, and reported so to him. In about ten minutes he called again. The line was still busy. He was very anxious for the line, and as the parties talking had exceeded the five-minute limit allowed on party lines, I asked them for the line. They replied that they paid for their service and expected to use it. I waited a few more minutes, thinking they would surely stop, but as they kept on talking, I took down the connection, and then rang my party.

I am glad to say, however, that we have very few such subscribers. We have many who hold long conversations, but most of them are perfectly willing to give up the line when central asks for it. At the same time, most operators dislike to ask for a line, and often report busy lines, whereas if all would respect the five-minute-conversation rule, much better service could be given.

It is my opinion that no class of subscribers appreciate good service like the farmers. On New Year's morning many of them called me, wished me a Happy New Year, and thanked me for a year's good service. Now perhaps on the same line, another farmer would say we give him bad service. That is strange, too, isn't it, for when a farmer line rings in central does not know which one is calling. The only explanation to this is the fact that all people are different, and some are so much harder to please than others. So we can only do our best, but let us be sure that it is our best.

Watch the drops closely. Keep the drops up on the board. Several drops down at once is confusing to an operator. Go in on the connections often. Don't depend too much on ring-offs. Some time people don't ring off, and sometimes the drops don't work, and a farmer living ten or fifteen miles from a town and a mile from a neighbor, cannot go to the next door and tell central to answer him.

Let us each and every operator here, work together and make 1916 a banner year in telephone service. Let us give our company the very best we can, think as much of the company's dollar as our own, and above all things keep in mind "better service."

From Factory and Salesroom

Conventions: Kansas, Topeka, February 15-17; Iowa, Des Moines, March 14-16; Texas, Fort Worth, March 16-18

New Edition of Mine-A-Phone Bulletin.

The Stromberg-Carlson Telephone Manufacturing Co., of Rochester, N. Y., has published a new edition of bulletin No. 1,000 on the Mine-A-Phone and its associated equipment. The new bulletin is nicely printed on a white dull coated paper stock. Many illustrations are shown which do full justice to the subjects they represent. The size of the bulletin is 7¾ inches by 10 inches, and is punched to fit the company's standard binder. The cover stock is a trifle heavier in weight than the inside pages, and upon the first page of the cover is shown an attractive illustration of a mine equipped with a Mine-A-Phone system.

An interesting report made by the United States Bureau of Mines appears in the introductory pages. It sets forth the many benefits of a telephone system in mines and tells at some length of the accidents of various natures which commonly occur in mines and which can be avoided to a considerable extent by the installation of a mine telephone system.

Complete information is contained in the bulletin on the several types of telephones best suited for surface stations, etc., and a practical plan is briefly outlined on how to go about the wiring, install the telephones, the bells and other miscellaneous parts which the installation of a telephone system would naturally involve. A diagrammatical view is shown which makes the instructions easily comprehended.

Any telephone company or interested party who desires to obtain a copy of this new bulletin should apply to the Stromberg-Carlson company's advertising department at Rochester.

Kellogg Exhibit at Wisconsin Convention.

The Kellogg Switchboard & Supply Co., of Chicago, had an exhibit of varied interest at the convention of the Wisconsin State Telephone Association held at Madison this week. As usual, the instantaneous recall demonstration switchboard aroused continued enthusiasm and the company's representatives were kept busy demonstrating its many advantages.

In addition to magneto and P. B. X. switchboards, of the efficient, compact, low-shelf type, the Kellogg exhibit included a universal switchboard demonstrating set that proved a strong attraction to managers of smaller magneto exchanges.

An occasion of much interest during the convention was the plan of getting "Dick Coyne on the line," so that the Kellogg men could give him personally their regards and good wishes. Mr. Coyne, as almost every telephone man knows, was the Wisconsin representative of the Kellogg company for a number of years and successfully represented the company's and its customers' interests. Mr. Coyne is now Pacific Coast branch sales manager, at San Francisco.

A novelty of the convention was the exhibit by the Kellogg company of a magneto telephone battery saver, service improver, which, it is claimed, is of vast importance on town and country telephone lines. This patented device is said to be, to use a time-worn phrase, "in a class by itself," in its simplicity, sureness of operation, money-saving results for the telephone manager.

A detailed account of this "Kellogg Battery Saver" will appear in these pages shortly and the Kellogg company will be glad to send a booklet completely describing this device on request.

A number of magneto telephones were equipped with this Kellogg battery saver and constant demonstrations were the order of the day.

Representing the Kellogg company were A. J. Carter, general sales manager; C. C. Huffman, Wisconsin representative, and F. L. Eldridge and H. W. Bryce.

"Skipper" Clark's Merit Recognized.

Business concerns are not always the grim, hard-hearted, calculating machines that many people consider them. Every once in a while one hears of a corporation doing a

fine, generous thing that seems to give the lie to the saying, "Corporations have no souls." That saying may be true, but it is often proved that the men back of the corporation have warm hearts and generous impulses which throw a glow of sunshine along the prosaic path of everyday life.

Frank L. Clark was one of the valued members of the Garford Mfg. Co.'s sales organization. His death was recorded in TELEPHONY's January 22 issue. His business associates mourned his loss sincerely and paid his memory a beautiful tribute at the funeral services. Nothing was left undone to assuage the grief of the stricken family by all who knew and worked with "Skipper" Clark.

The Garford company, it is learned, has shown its appreciation of Mr. Clark's faithful services in a most practical way, as it proposes to pay his widow his salary for the next six months on the ground that the results of the good work the deceased did for his employers will not end with his death. This recognition of faithful work by a worthy representative is not only a fine tribute to his memory, but is an indication of a broad gauge, generous policy on the part of the company which cannot but increase the loyalty of its employes.

Phoney Bill on "Talking Machines."

Folks may talk about the wonders of the Victrola, the Edison and other types of phonographs but, pointing at a Stromberg-Carlson desk stand—as shown in the accompanying reproduction of the February blotter calendar of the Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.—Phoney Bill says: "You should try this talking machine."

The dates for Lincoln's and Washington's birthdays, the 12th and 22nd, respectively, are displayed in red letters on this month's calendar. Below are given, in blue letters, the dates for the convention of the Wisconsin State Telephone Association, to be held at Madison on February 9, 10 and 11, and the convention of the Kansas Independent Telephone Association, to be held at Topeka on February 15, 16 and 17.

Phoney Bill Says: "You Should Try This Talking Machine."

Paragraphs.

THE COFFEY SYSTEM & AUDIT CO., of Indianapolis Ind., recently made the annual audit for the Citizens Telephone Co., of Cambridge City, Ind.

General Insulate Co. Reports Good Year.

General Insulate Co., 1008-1014 Atlantic avenue, Brooklyn, N. Y., manufacturer of "Insulate" and "Hi-Heat" specialties for electrical, automobile and other purposes, reports that the year just closed has been (with the exception of 1913, which was the banner year not only in the history of the General Insulate Co., but many other firms), the best year both for net results and volume of sales in the company's history. Orders are coming in very freely and the company's officials are looking forward to a still better year in 1916.

Ralph E. MacDuff Retires from Telephone Field.

The announcement that Ralph E. MacDuff is to retire from the telephone field, will, undoubtedly, be surprising as well as disappointing to his friends who are legion in the telephone field. Mr. MacDuff, secretary and treasurer, of the Paragon Electric Co. for the past six years, leaves that organization March 1, to become affiliated with the Packard Motor Car Co., of Detroit, Mich., in its truck sales department.

Ralph E. MacDuff.

To Mr. MacDuff for his geniality, unceasing efforts and industry must be attributed, in a large measure, the success which Ironite has enjoyed since his association with the Paragon Electric Co. Mr. MacDuff, who has boosted Paragon specialties "for the good of the service" from Edmonton, Alberta, Can., to Key West, Fla., has not only made numerous and lasting friends everywhere, but it is evident that his company, as a result of his efficiency, has prospered greatly. He is leaving the telephone field rather reluctantly and solely because the prospects with the Packard Motor Car Co. are so alluring and inviting that he does not feel he can ignore the opportunity presented.

Mr. MacDuff has been a habitué of state and national telephone conventions. He is an enthusiastic Jovian and a member of the Electric Club-Jovian League of Chicago. He was one of those responsible for the organization of the Paragon Electric Co., having been one of the original stockholders of the Durant Electric Supplies Co. His relations in the telephone field even antedate the Paragon Electric period, as he was formerly Eastern representative of the Frank B. Cook Co., successfully covering all territory east of the Mississippi River.

Considering the fact that he is still a young man, being 34 years old, he has not only prospered well in a business way, but it might aptly be said that he is a "multi-millionaire," inasmuch as he has four children—two boys and two girls—for whom he would not take one million dollars apiece. Mr. MacDuff is an enthusiastic Elk and royal arch Mason, as well as a very promising golfer.

Although he is severing his connections in the telephone field, TELEPHONY hopes that it does not mean "finis" and that his future activities will occasionally, if not frequently, bring him in contact with his many old friends in the telephone field who wish him well and the success that he deservedly merits.

New Exchange Building for Roundup, Mont.

A study of the commercial development and population growth of Roundup, Mont., is being made by the Mountain States Telephone & Telegraph Co. as a basis for plans which are being drawn for a new building and common battery plant.

Out of the Mail Bag

The month of January brought TELEPHONY many messages of good will and kindly wishes from the telephone men of the country. In renewing their subscriptions for 1916, many of our readers took occasion to express their satisfaction with the journal and extend wishes for a successful, prosperous season during the coming year. TELEPHONY reciprocates all the good wishes and sincerely hopes that 1916 will be a banner year for all its friends in the telephone field.

The year starts out under favorable auspices. It promises to be a busy one, generally speaking, and with the United States, no doubt will be a momentous one, considering that it will be marked by a presidential election. Here's hoping that we all do our share to keep not only the ship of state, but the commercial craft of the country in safe and pleasant waters and that we all enjoy the voyage in 1916!

J. E. Stephens, general manager of the Ashland (Kan.) Telephone Co., writes: "Enclosed find draft to pay our subscription for another year. We want to compliment you upon your 'want card' results. We filled out one with the idea of getting information relative to the purchase of materials we might need later, and believe we heard from practically every firm of any size in the respective lines in the country since then. Keep up the good work on the 'Home Courses' and others of like nature, as well as the questions on theory and practice. They certainly make the magazine worth many times what you charge. When we get our TELEPHONY here each week, there is a scrap as to who gets to read it first. We wish you success for the coming year."

O. F. Goodrich, owner of the Antelope Valley Telephone Co., Lancaster, Cal., in a recent letter says: "I have been a subscriber for years to your telephone journal, and find it of great value. I consider the money for the subscription well spent. No telephone exchange should be without it. We are continually building and extending our lines and not only find TELEPHONY interesting, but of great benefit. We get pointers from it we could not get elsewhere for many times the price. It also keeps us in touch with all the enterprising companies from California to New York."

Here's one from far New Zealand. A. W. F. Pooley, of Auckland, sends in his remittance for his 1916 subscription, and adds: "I might state that the issues of TELEPHONY for the past year have been very interesting. The telephony courses are extremely helpful and I am indexing them myself for personal reference. No doubt an index will be published when the courses are completed and will prove very useful."

"We like TELEPHONY very much and would not think for a moment of trying to do without your valuable paper," writes N. Starkey, owner and manager of the Eastern Kentucky Home Telephone Co., of Pikeville, Ky.

H. E. Reinhold, of the Tuscarawas County Telephone Co., New Philadelphia, Ohio, in a letter enclosing his subscription remittance, says: "This last year's issues have been exceedingly fine. I cannot conceive how anybody can miss the Home Study Course or the 'Fundamentals of the Telephone Business,' and still call himself a telephone man. Mr. Kelsey's articles are always eagerly read. Let us have them continued. I wish you a prosperous year."

Bernard W. Leavitt, of the City Telephone Co., of Southern Pines, N. C., in a recent letter, says: "I am enclosing our check to keep TELEPHONY coming, as we can't do business without our staunchest friend."

In a letter enclosing money order for his subscription for 1916, A. W. Field, of Detroit, Mich., says: "Your magazine is very instructive, and the Home Study Course is worthy of recognition for all employers and employes of telephone companies. May this year tend to increase the quality as heretofore. I wish you success in 1916."

James G. Quill, of South Portland, Me., in making remittance paying his subscription two years in advance, says: "I consider TELEPHONY one of my best friends and am glad to get it always. I wish you continued success and many Happy New Years."

J. H. Jensen, city electrician of Ephraim, Utah, writes: "Enclosed you will find my check for subscription to TELEPHONY for another year. I am not a telephone man, but enjoy your paper more than any other electrical paper, and always look forward to the coming of TELEPHONY."

In sending in money order for his renewal, Chester A. Ohmart, Girard, Ill., says: "Had intended to discontinue my subscription January 1, but find I can't get along without your paper."

E. R. Fisher, of the Southwestern Home Telephone Co., San Jacinto, Cal., sends in his renewal for 1916 and adds: "I would not care to be in the telephone business and not receive your paper. It is a great help in numberless ways. To try to enumerate them all would be useless. The Study Courses now running are especially good. Hoping TELEPHONY will continue to uphold its standard and with best wishes for its future success, I am," etc.

G. Henry Davis, of Tilton, N. H., sends in his subscription *for five years in advance*, and then says: "May TELEPHONY prosper progressively in the next five years! I do not consider it subject to essential improvement at present. Of course, Smith, Jones or myself might prefer more of this, that, or the other subject matter, but for us all collectively, it really is very sufficient. Like current furnished over a divided circuit, we each absorb as much (benefit) according as we adjust our (mental) resistance. I surely will boost for TELEPHONY if I am ever in a position to do so with effectiveness. May I presume to wish you personally health and success in full measure during the many years I hope will be allotted to you?"

G. W. Hubbard, Madison, Ga., sends in his check for subscription and says: "I am very well pleased with the paper. I am not interested financially in the telephone business, but expect to be soon, so I have been reading TELEPHONY to post myself upon the business. One article regarding magneto troubles was well worth the subscription price to a beginner."

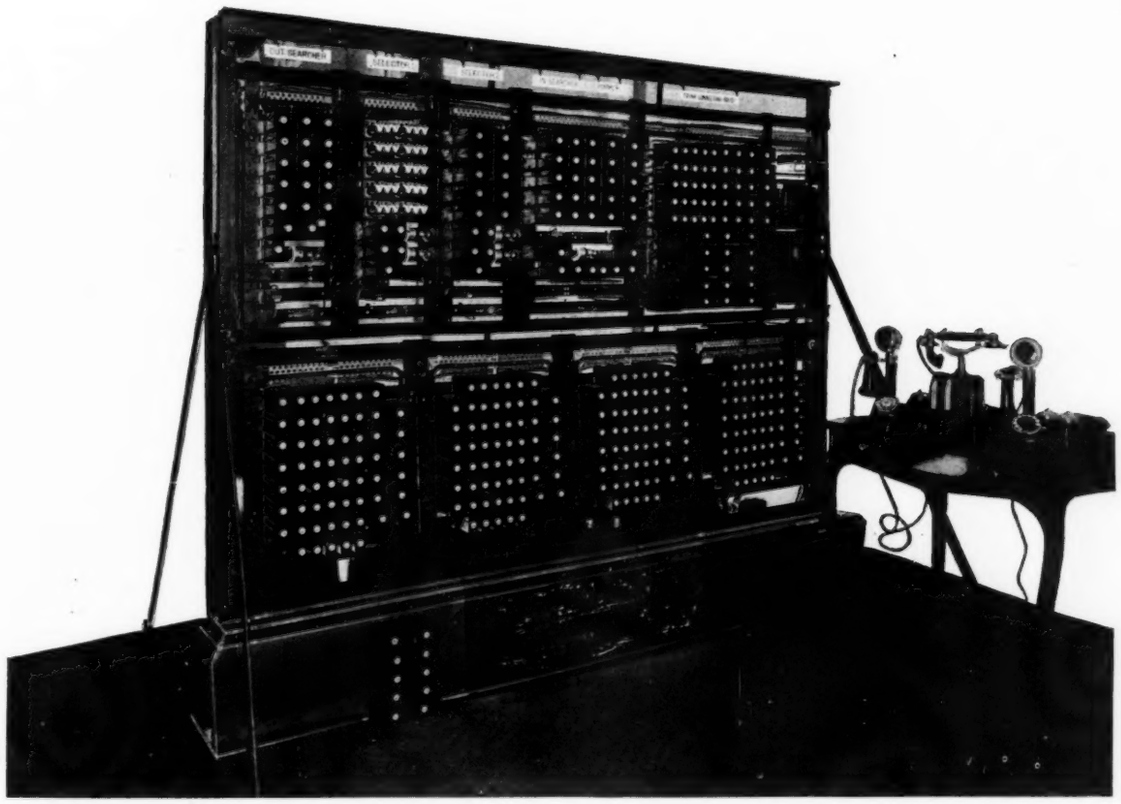
E. C. Kaiser, wire chief of the West Concord (Minn.) Telephone Co., in a letter enclosing money order for his subscription, says: "And keep it coming. Every copy of TELEPHONY is a little better than the one before."

In writing in for an additional copy of TELEPHONY, H. M. Rounce, of Ripley, Ont., Canada, adds: "I do not want to miss a single number."

P. A. Henderson, South Bend, Ind., writes: "While in the telephone business I certainly want TELEPHONY as I find it not only interesting to read, but instructive and helpful as well."

"Allow me to thank you for the many points of information and valuable suggestions we have received during the past year from TELEPHONY," says W. S. Chandler, of the Mt. Olivet & Bridgeville Telephone Co., Mt. Olivet, Ky.

THE LATEST IN AUTOMATICS



A 4300 Mile Trip in War Time

This is a picture of the Switchboard that made the journey. The time was short; the packing was hurried; the material was hustled in and out of express cars, and bustled in and out of the steamship. We were anxious to see how it would come out.

The Damage

The total damage was two insulating studs broken. The repair cost but a few minutes' time, the material being too small to figure.

Moral

Relays Are Good Workers and Good Travelers.

Address in Care of **Marconi Wireless Telegraph Co. of America, Woolworth Bldg., New York**

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

Condensed News Reports

Officers of Companies Are Urgently Requested to Forward to Us Promptly All Financial and Other Statements as Soon as Issued and Any Items of Interest as to Their Plants and Systems

Personal.

H. G. WOODWARD, of St. Joseph, Mo., has been appointed district manager of the Missouri & Kansas Telephone Co., with headquarters in Coffeyville, Kan., to succeed M. C. Butterfield, who resigned to accept a position with the Western Electric Co.

THOMAS R. GENTRY, district manager of the Southern Bell Telephone & Telegraph Co., at Atlanta, Ga., has been appointed commercial superintendent of division 1, embracing the states of Georgia and Alabama. His headquarters will be in Atlanta and he will report to General Manager F. L. Woodruff.

MACON MARTIN, commercial superintendent of division 1 of the Southern Bell Telephone & Telegraph Co., has been promoted to the office of commercial engineer of both the Southern Bell and Cumberland telephone companies. His headquarters will be in Atlanta and he will report direct to First Vice-President J. E. Brown.

New Companies and Incorporations.

HERINGTON, KAN.—At a general meeting of stockholders of the Mutual Telephone system it was decided to organize a new company which should take over the stock of the old company. The new company is to be capitalized at $20,000. Shares will be sold at $25.00 and shares held by the old company will be taken over at $7 each. About $3,000 worth of stock in the new company was sold at this meeting.

BLUE EARTH, MINN.—At a meeting held recently a new telephone company was organized to be known as the "Village of Frost Telephone Company," and officers elected as follows: G. G. Frandle, president; A. J. Nelson, vice-president; W. C. Anderson, secretary; C. C. Johnson, treasurer; Hartman Njoes, lineman. Trustees: Edw. Knutson, one year; R. J. Underdahl, two years, and John H. Njoes, three years.

ROUNDUP, MONT.—The Parrott Creek Telephone Co. has filed articles of incorporation, with an authorized capital of $7,500, for the purpose of building, acquiring and operating a telephone system at the town of Gage and surrounding territory.

BURNS, ORE.—Articles of incorporation have been filed by the Intermountain Telephone & Telegraph Co. of Burns. It has a capital of $20,000.

HAZELHURST, WIS.—The Hazelhurst Telephone Co. was incorporated recently with a capital stock of $500. Incorporators are J. C. Schwarts, A. Johnson and H. C. Lowe.

Financial.

LEXINGTON, KY.—The Fayette Home Telephone Co. has declared quarterly dividends of 1½ per cent. on both the common and preferred stock.

Construction.

OWOSSO, MICH.—At a meeting of the Union Telephone Co. an expenditure of not to exceed $38,500 was authorized for the purpose of reconstructing and extending lines of the company in the southern and western parts of Owosso.

CARLTON, MINN.—Manager A. G. Thompson, of the Zenith Telephone Co., has announced that extensive repairs and improvements will be made to the company's lines in this city. A new switchboard and all new office equipment will be installed.

CONCORD, N. C.—Secretary and Treasurer L. D. Coltrane of the Concord Telephone Co. has announced that the company plans to begin at once the erection of a telephone building on East Depot street immediately in the rear of the Concord National Bank.

Election.

OZARK, ARK.—The stockholders of the Home Telephone Co. held their semi-annual meeting recently and elected the following directors: M. B. Conatser, president; H. A. Nickell, vice-president; D. B. Anderson, secretary; other directors, Whit Martin and J. T. Greer.

TAMPICO, ILL.—The Tampico Farmers Mutual Telephone Co., has elected officers for the ensuing year as follows: L. A. Wheelock, president; John Dailey, secretary, Levi Lutgens and N. L. McKenzie, directors.

TREMONT, ILL.—The Farmers' Telephone Co. held its annual meeting recently. An election of officers was held with the same ones being retained. The officers are John S. Sommer, president; John Strickfaden, vice-president; George F. Brecher, secretary-treasurer-manager; trustees—J. Augsburger, H. A. Bolliger, Samuel Kinsinger, A. L. Robinson and Peter Sweitzer.

JUDSON, IND.—The Judson Telephone Co., elected directors for the year as follows: O. T. Payton, president; O. A. Weatherford, secretary; A. C. Jolly, treasurer.

LAGRANGE, IND.—The People's Mutual Telephone Co. has elected officers for the ensuing year as follows: Moses P. Miller, president; Harry Bogue, vice-president; Lorin Babcock, secretary; Marion Garmine, treasurer. These officers with R. Gushwa comprise the board of directors.

MILLERSBURG, IND.—The annual meeting of the Farmers' Mutual Telephone Co. resulted in the election of W. H. Stoner as president; Simon Yoder, vice-president; L. F. Juday, secretary, and C. E. Freeland, treasurer. These officers with Henry Haines, Edward Rogers and Wilson Ott comprise the board of directors.

NEW MARKET, IND.—Directors of the New Market Telephone Co. were elected for the ensuing year as follows: William Pinkley, George Himes, W. J. Miles, president; John Childers, vice-president; Edgar Wray, secretary-treasurer.

BRITT, IOWA.—The Britt-Crystal Farmer Mutual Telephone Co. held a meeting recently and elected A. O. Christianson, president; J. H. Mortenson, secretary; L. P. Olson, N. P. Rasmusson, P. H. Hanson, Louie Weber and A. O. Christianson, directors.

COUNCIL BLUFFS, IOWA.—At the annual meeting of the Independent Telephone Co. officers and directors were elected for the ensuing year as follows: President, E. H. Merriam, Council Bluffs; vice-president, C. G. Saunders, Council Bluffs; secretary, C. D. Parmalee, Omaha, re-elected; treasurer, T. G. Turner, Council Bluffs, re-elected; auditor, W. A. Pixley, Omaha, re-elected; counsel, C. G. Saunders, Council Bluffs, re-elected; executive committee, G. H. Pratt and W. A. Pixley, both of Omaha, re-elected, and W. B. T. Belt, Omaha; directors, C. G. Saunders, E. H. Merriam, T. G. Turner, Frank Elgan, Council Bluffs; C. E. Yost, G. H. Pratt, C. D. Parmalee, W. B. T. Belt and W. A. Pixley, Omaha; all re-elected but Mr. Elgan and Mr. Belt.

BELLAIRE, KAN.—The Bellaire Telephone Association held its annual meeting recently and elected the following officers for the ensuing year: Elmer Isom, president; G. C. Hutcherson, treasurer, and George Post, secretary.

SIOUX CITY, IOWA.—At a meeting of the stockholders of the New State Telephone Co. the following officers were elected for the ensuing year: Howard S. Baker, president; W. H. Leathers, vice-president; C. H. Pettey, secretary, treasurer and general manager. The same board of directors was re-elected with the exception of Joseph Mattes, of Obebolt, who resigned and whose place was filled by C. H. Pettey.

HIAWATHA, KAN.—The stockholders of the Mutual Telephone Co. held their annual meeting. John Kale and Leonard Bearce were re-elected directors and Stephen John was elected to succeed R. V. Brokaw. The directors held a meeting and re-elected the following officers: Wm. Morisse, president; John Kale, vice-president; C. O. Dimmock, treasurer.

SPRING HILL, KAN.—The stockholders of the Mijo Co-Operative Telephone Co. held their annual meeting recently and the entire old board was re-elected. It includes J. L. Rennick, George Eccles, S. C. Ramey, Irwin Williams, John Newton, T. G. Stuckey and T. A. Cave. The board re-organized by electing J. L. Rennick, president; George Eccles, vice-president; S. C. Ramey, secretary; John Newton, Irwin Williams and S. C. Ramey, executive committee.

ALAMO, MICH.—The Alamo Mutual Telephone Co. has elected the following officers: President, B. F. Hollowell; vice-president, B. J. Barber; secretary and treasurer, F. E. Russell. One director, J. Q. Adams was re-elected. The other directors are Walter H. Snow, John B. Kitzmiller and George Campbell. Manager, B. J. Barber.

BURR OAK, MICH.—The stockholders of the Southern Michigan Telephone Co. held their annual meeting recently. The following board of directors was elected: A. C. Heimbach, Roy E. Heimbach, Thomas A. Hilton, Charles H. Hutchinson, William S. Allen, Frank W. Wait. A. C. Heimbach is president of the company and Roy C. Heimbach secretary and treasurer.

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CORNING, MICH.—The following officers were elected at the annual meeting of the Leighton Telephone Co.: President, Roscoe Smith; vice-president, Samuel Hanna; secretary, Titus Hunsberger; treasurer, G. E. Steeby; trustees, A. J. Bowman, W. H. Jackson and G. W. Heintz.

JONESVILLE, MICH.—At the annual meeting of the Fayette Rural Telephone Co. the following officers were elected: President, Charles T. Kimball; secretary, Robert E. Carter; treasurer, Eugene C. Adams.

MORRICE, MICH.—The following officers were elected at the annual meeting of the West Antrim Telephone Co.: President, William Eddington; vice-president, Robert Ralph; secretary, A. L. Beard; director, Frank Snell; manager, Harry Cunningham; auditor, James Jordan.

FORBES, MINN.—The annual meeting of the Forbes Rural Telephone Co. was held recently and officers for the year elected as follows: President, Andrew P. Quaal; vice-president, Pat Cobb; secretary-treasurer, J. Mabreten; directors, Charles Newberg and T. Soine.

HOKAH, MINN.—At the annual meeting of the Hokah Telephone Co. the following officers were elected: William Guenther, president; Hugo Schmidt, vice-president; F. C. Sobek, clerk; H. Kelly, treasurer; H. E. Wheaton, director for three years; G. F. Scheck, director for two years.

FORREST GROVE, MO.—The following officers were elected at the annual meeting of the Forrest Telephone Co.: Karl Lupberger, president; C. G. Hare, vice-president; R. W. Slack, secretary; William Lupberger, treasurer, and August Favre, trustee.

SAVANNAH, MO.—The stockholders' meeting of the Andrew County Mutual Telephone Co. was held recently. The new board of directors elected includes Frank Kneale, of Fillmore; W. E. West, of Bolckow; George Baum, of Rosendale; O. V. Sells and C. E. Stephenson, of Savannah, Mr. Stephenson and Mr. Baum being new members of the board.

CORTLAND, NEB.—The annual meeting of the stockholders of the Cortland Telephone Co. was held recently. The election resulted in the re-election of David Boesiger, William Pape, F. H. Pape and C. A. Moore as members of the board of directors.

STEELE CITY, NEB.—At their thirteenth annual meeting the stockholders of the Steele City Telephone Co., the board of directors was reduced from five to three. T. Williford, W. V. Brady and George F. Crane constitute the new board.

MOLALLA, ORE.—The Molalla Telephone Co. held its annual meeting and elected the following directors: A. F. Moshberger, W. W. Everhart, G. J. Case, E. L. Palfrey and G. V. Adams.

WINONA, OHIO.—The Winona Central Telephone Co. has elected officers for the coming year as follows: President, J. E. Walton; vice-president, Frank Coppock; secretary, Joshua Jenkins, manager, Dillwyn Stratton; assistant manager, Joshua Brantingham.

TRENTON, TENN.—The stockholders of the Gibson County Telephone Co. assembled recently in annual meeting. R. R. Collins was elected president; G. A. Davidson, vice-president; and E. Greer, secretary-treasurer. J. W. Moore was re-elected manager.

CHIPPEWA FALLS, WIS.—The County Telephone Co. held its annual stockholders meeting recently and elected the following directors for the ensuing year: J. W. Thomas, George Stewart, F. B. Chas. Charles A. Liehe, Earl S. Barker, Herman Hass and Joseph Kelly.

OSCEOLA, WIS.—At the annual meeting of the Osceola Farmers Mutual Telephone Co. B. J. Rochel was re-elected director for a term of three years. The board of directors now consists of M. J. O'Rielly, B. J. Rochel and Fred Pilgrim. The secretary's report showed the company to be in a good condition. At a subsequent meeting of the directors officers were elected as follows for the ensuing year: M. J. O'Rielly, president; B. J. Rochel, vice-president; Samuel F. Oakey, secretary; and W. C. La Rue, manager.

Miscellaneous.

LITTLE FALLS, MINN.—Sobieski Rural Telephone Co. is the name of a new organization with headquarters in the newly organized village of Sobieski, Swan River town. This new company purchased what is known as the Fawndale telephone line, which has been owned and operated by the Northwestern Telephone Exchange Co. The new company has organized and elected officers as follows: President, Father A. J. Gospador; secretary, Anton Koziol; treasurer, P. J. Chock; manager, J. J.

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